NOVEMBER 14, 1960

American Machinist / Metalworking Manufacturing

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Spot checking a part produced on 3-spindle numerically controlled profile mill—see page 123

- **Chipless machining goes automatic,** page 109
- **Handling system triples shear output,** page 120
- **Incentives speed job-shop assembly,** page 134

NEW HEALDRILL

...a high-precision drilling machine designed for fully automatic NUMERICAL CONTROL OF ALL FUNCTIONS

The *completely new* Healdrill offers you, for the first time, a high-precision, heavy-duty layout or production drill that's designed to take full advantage of modern numerical control.

This ruggedly-built machine includes tape control of table positioning, speeds, feed rates, automatic "Z" axis cycle and tool-change indication. When a series of holes of the same size are to be drilled, counter-bored or reamed, the cycle is fully automatic, freeing the operator for other work. At each different hole size the cycle stops automatically and a "tool change required" signal light goes on. After change is made, hole is automatically positioned and drilled at correct feed and speed.

Available with "ACRAMATIC" punched tape control by Cincinnati Milling Machine Co., the Healdrill permits simple, direct programming of all functions — tape reading rate of 1200 lines per minute — full range zero shift on both axes — repeatability of ± .0002" — accuracy of positioning to ± .001" — and complete manual control from the console when tape is not used.

SPECIFICATIONS

Table Size	24" x 56"
Longitudinal Table Travel	48"
Transverse Table Travel	20"
Vertical Range	0-30"
Spindle Speed Range	30-1800 rpm in 16 steps
Feed Range	.002"-.030" per rev. in 8 steps

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CIRCLE 151 READER SERVICE CARD

COVER:
A numerically controlled 3-spindle Pratt & Whitney Keller machine at Boeing in Wichita. Details on Boeing's N/C programming on page 123.

American Machinist / Metalworking Manufacturing

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TURN PAGE FOR METALWORKING REPORT⟶

CIRCLE 151 READER SERVICE CARD

METALWORKING REPORT . . .

. . . what's new and significant in manufacturing techniques and materials—direct from our own staff and round-the-world news bureaus

FORMING . . . Piggyback dies (what a simple idea, now we think of it) use up press daylight, not bed width. W S De Moss, Indianapolis, pins die sets together and operates them with one press stroke. Die that takes the least pressure completes its stroke first, so press load is spread out. Stamping and drawing can be combined, and a multi-operation part may be shifted between several dies--even progressives--to reduce handling and lost time. For details, see p 114.

MACHINING . . . Gear-cutter protector that senses cutting overload and shuts down the machine has been announced by Michigan Tool Co for new gear shavers and existing machines in the field. The cutting-load meter is rigged with two pointers; one is adjustable to set a load limit, and the other indicates actual load. The sensing mechanism operates by continuously checking armature current in the drive motor, which is sensitive enough to register work-size variations in the thousandths.

MANUFACTURING CONTROL . . . Incentives for short-run assembly pay off at Warner & Swasey, where 275 machine-tool assemblers pull down regular bonuses. Main requirement is standards for each assembly operation--and it doesn't matter if it is job-shop work. See p134.

FINISHING . . . Universal spray gun will fire anything with viscosity between 10 and 18,000 centipoises, and has been applied for polyester laminating resins, gypsum cement, and plastisol rubber. U S Gypsum Co developed it for air pressure of 40 to 90 psi, at 8 to 12 cfm rate of flow, to carry 1/2 to 4 lb of material per minute, depending on composition. The gun is a refinement of an earlier model for epoxy resins only.

INSPECTION . . . Ultrasonic beams that bend corners and can follow through flexible tubing to remote locations are applied with Sonac control units built by Delavan Mfg Co. The two battery-powered sensors and a control unit can be set up to detect seams in sheet, to control machine operation for safety reasons, and to count and sort. The device works much like an electric eye, but it is less sensitive to dust, and will penetrate liquid or paint.

CUTTING . . . New method of rating bevel and hypoid gear teeth based on pitting resistance has been developed by Gleason. In the past, surface capacity was rated by a formula based on field experience. New method reported by Wells Coleman of Gleason permits closer limits in designing gears and their mountings. It is available from American Gear Manufacturers Association, Paper No. 229.05.

MACHINING . . . High-powered electrolytic machining, developed by Battelle Memorial Institute for Steel Improvement & Forge Corp in Cleveland, increases metal-removal rates 500 times or more. Power at 1500 amps/sq in. and 15 volts is applied to remove 0.5 to 1.0 in. of metal in 10 minutes. The technique applies a 0.003- to 0.005-in. film of flowing electrolyte instead of a still solution. Fresh electrolyte flushes away metal ions immediately. Typical metals worked include Waspalloy, tungsten, H-11, etc; see p 113.

FINISHING . . . Moving electrolyte also speeds up plating—Steel Improvement & Forge has deposited 0.020 in. of chromium per hour in tests, and a 0.0006-in. film of copper was plated into a 1.2-in. hole (area of 5 sq in.) in 30 seconds. Pressurized electrolyte flow (Sipco Speed Plating) provides constantly fresh solution and greatly increased current density. This may permit plating in the shop instead of in a plating room, and may lead to line plating to produce cylinder liners in aluminum engine blocks.

MATERIALS & COMPONENTS . . . Roller-chain power ratings have just been issued by the Association of Roller & Silent Chain Manufacturers as a result of long-term studies of roller impact forces, dynamic tension forces, efficiency, and wear life. The tables are based on more accurate predictions of wear life than previously available, and include data for operation at speeds formerly considered impractical.

FORMING . . . More versatile cupping tests are possible with Tinius Olsen's new "Duct O Matic" bench machine. It exerts infinitely adjustable hydraulic pressure on the cup flange, and indicates depth of cup and plunger load as the test piece is drawn. Tendency of the sheet to produce flow figures, tears, scallops, or ears can be studied, and forming quality can be predicted. The test also helps to cull out defective material.

FINISHING . . . Single-treatment color coating will apply any color to any metal at lower cost than anodizing or painting. The Hinac process, developed jointly by Pennsalt Chemicals and Heintz div of Kelsey-Hayes, is now owned by Pennsalt. The coating is claimed highly resistant to chemical action of acids, alkalis, and solvents.

WELDING . . . Soldering iron with a self-contained heat source has been developed by Jenolite, Ltd, in London. A steel-shelled cartridge that contains exothermic chemicals is inserted in the iron. A trigger sets it off to produce 10,000 calories, holding soldering temperature for 8 minutes. Lack of wires or open flames make it a good tool for difficult-access spots and explosive atmospheres.

Continued on next page

Coming in AM/MM

How job shops can get production-line economies

. . . details on operations research applied to short runs.

METALWORKING REPORT . . .

ASSEMBLY . . . Fast torch soldering at Continental Controls is based on a mechanized indexing table produced by Fusion Engineering, Cleveland, for under $1000. Operator places assembly parts under the nozzle of a solder applicator that automatically dispenses a metered mixture of solder-and-flux paste, then locates parts in spring-retainer holders on table. Parts index past preheat and final-solder torches, then air-cool. Soldering mixture may be applied automatically to simpler assemblies.

MATERIALS & COMPONENTS . . . Super-strength wrench sockets announced by Kaylock div of Kaynar Mfg Co are claimed to stand double the torque load specified for standard tests, and have been tried under severe conditions by aircraft and engine manufacturers without a single failure. The socket design includes 12 rounded gripping pads that contact wrenching edges away from the actual points. This puts pressure on the wrenching flats where there is more strength.

MATERIALS HANDLING . . . Painted line on the floor guides a British platform truck equipped with photocells that control the steering. Conveyancer Fork Trucks, Ltd, also builds in a proximity detector that slows the truck 6 ft from an obstruction, stops it at 2 ft, and blows a horn for help. The builder says nothing about pranksters with paint buckets.

INSPECTION . . . Ultrasonic transducers with 360° radiation are located inside rotor blades for Bell helicopters to check lamination bond structure. The barium titanate crystals, developed by Automation Industries, emit a signal up to 1 in. wide (⅜ in. is the present limit) to 10-megacycle lithium sulphate receivers outside the rotors.

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CINCINNATI

FILMATIC

WHAT'S YOUR FIRST CHOICE?

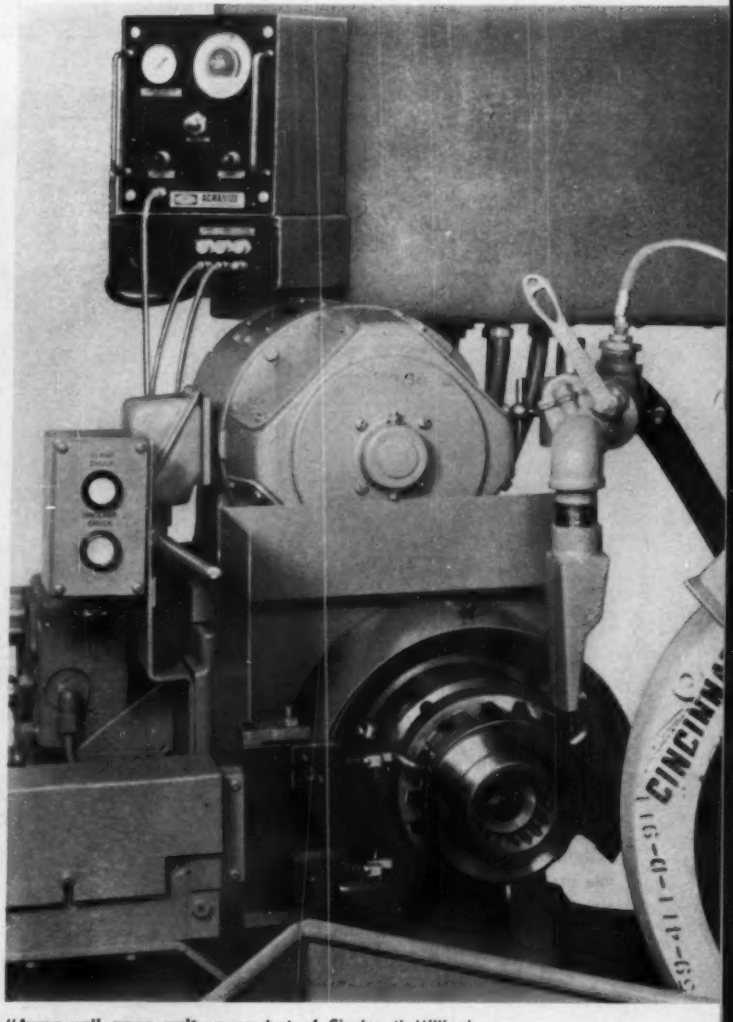
Cincinnati helps you select the best of 5 methods of precision cylindrical grinding . . . Let's consider **CHUCKING**

Borderline applications are common for every machining method. Choice of the right one is contingent upon experience and the impartial approach to similar methods and types of equipment. That's why Cincinnati Grinding Specialists can spot the appropriate grinding application so quickly. These men are thoroughly familiar with and can recommend:

Centertype grinding *(plain, universal, gap, roll)*
Centerless grinding
Micro-Centric grinding
Angular wheel slide grinding
Chucking grinding

Let's consider chucking grinding, and the many reasons why Cincinnati can give you the finest machines and engineering service for this type of work. First of all, the grinding wheel spindle runs on Cincinnati's famous FILMATIC bearings, over 99% of which have never required adjustment or replacement. A super-accurate headstock spindle puts Cincinnati chucking grinding in the precision accuracy bracket of other methods. Automatic dual rate infeed (standard equipment) combines rapid metal removal with accurate sizing. The two-spindle headstock is recommended for difficult-to-load parts. With this type of equipment, loading and grinding proceed simultaneously.

Cincinnati's Cimtrol Division engineers the gaging equipment, giving you the advantage of single responsibility. "Jump-on" gaging, a unique type of size control, is one of the profitable features of the CINCINNATI Chucking Grinder illustrated at the right. Other machines and the types of work they are performing are illustrated on the two pages following. **Grinding Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**



"Jump-on" gage unit, a product of Cincinnati Milling's Cimtrol Division, calls the signals for sizing and automatic cycle grinding. This CINCINNATI FILMATIC No. 2 Chucking Grinder is arranged to grind four sizes of parts.

Part name ..... Bevel gear
Operation ..... Grind diameter and adjacent face
Production ..... 72 per hour

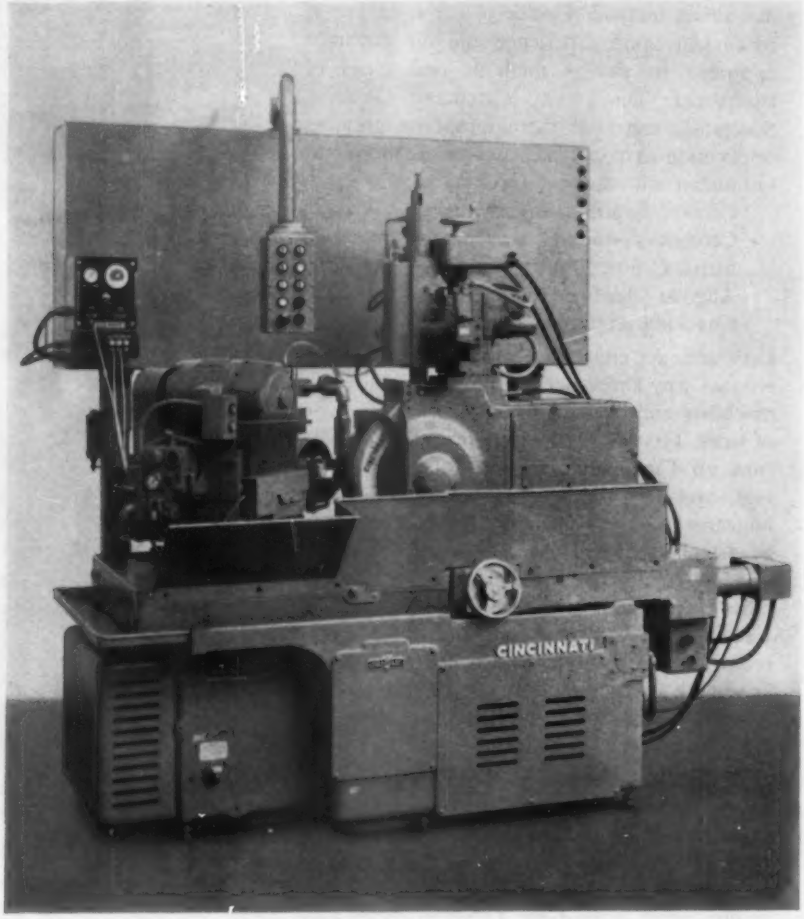
PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC • ROLL • CHUCKING • CENTERLESS LAPPING

CINCINNATI®
GRINDING MACHINE DIVISION

CINCINNATI combines

SUPERIOR CHUCKING GRINDER PERFORMANCE with WIDE VARIETY OF TOOLING

FILMATIC®



Production and quality are automatically controlled by the ingenious tooling and extra equipment, principally of standard design, on this CINCINNATI FILMATIC No. 2 Chucking Grinder. These fine precision grinders are built in two sizes:

No. 1—Capacity 0" to 4" diam.
No. 2—Capacity 2" to 10" diam.
Catalog No. G-685

BUILDERS OF PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC

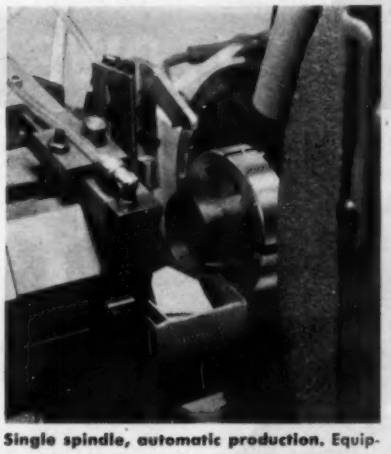
THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

The chucking method of grinding is expanding. Cincinnati has given it a well-deserved forward push with superior engineering service and outstanding machines. Operations include the grinding of diameters, shoulders, bevels, faces and combinations thereof, in quantities of several hundred or millions.

These fine chucking grinders are built with single spindle or two-spindle headstocks to give you a choice of automatic or manual loading. They can readily be tooled up with a variety of positive chucking and work locating arrangements. Production equipment you'll want to know about includes automatic profile truing; crush truing; gap eliminator to reduce the time spent in "grinding air"; automatic cross feed compensation for wheel wear and truing.

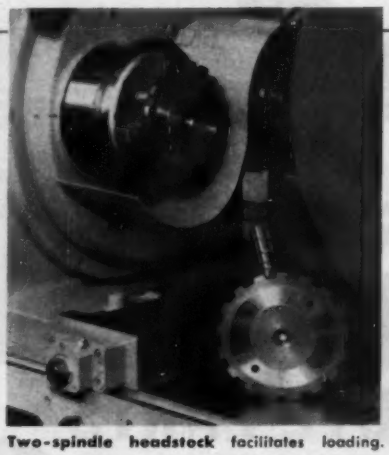
Many unusual types of work are now recommended for the chucking method of precision grinding. Examples which have been tooled up by Cincinnati are illustrated here. Many more, and complete specifications, will be found in catalog No. G-685. May we send you a copy?

CINCINNATI



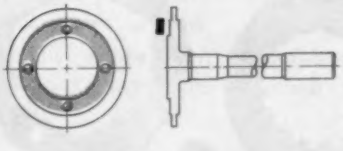
Single spindle, automatic production. Equipment includes air-electric gage sizing, cross slide compensation, automatic loading, etc. Black line in part drawing indicates ground diameter.

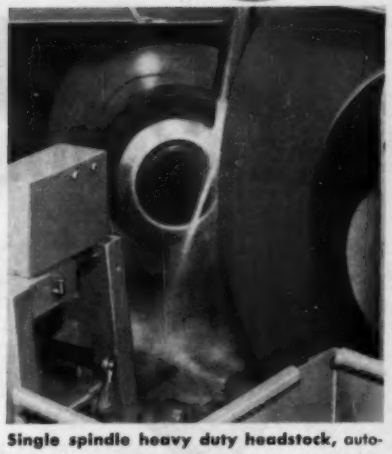
Part name ..... Clutch race
Operation ..... Grind O.D.
Material ..... Steel
Production ..... 192 per hour



Two-spindle headstock facilitates loading. Production items: automatic truing including cycle counter, gap eliminator to reduce time spent in "grinding air." Finished ground part is shown in foreground. Black line and shaded area in part drawings indicate ground surface.

Part name ..... Output shaft
Operation ..... Grind face
Material ..... Steel
Production ..... 120 per hour





Single spindle heavy duty headstock, automatic grinding cycle, pneumatic chuck with interchangeable jaws are combined to grind 13 sizes of parts. Black line in part drawing indicates ground surface.

Part name ..... Valve core
Operation ..... Grind radius on seat
Material ..... Stellite hard facing
Production ..... 20 to 35 per hour, depending upon size

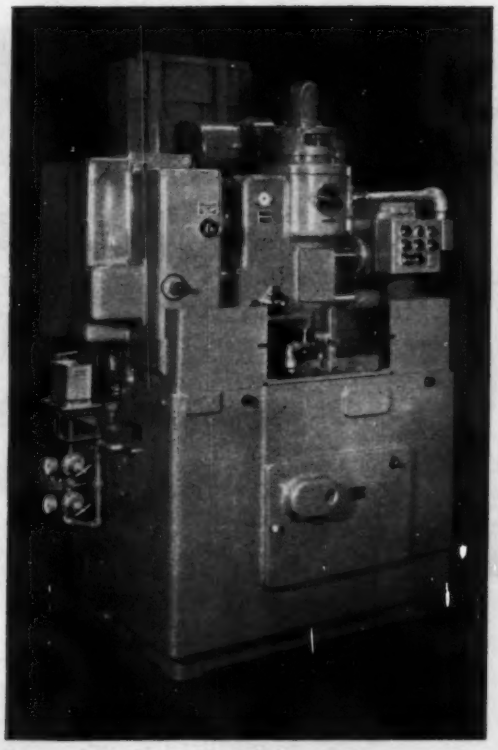
• ROLL • CHUCKING • CENTERLESS LAPPING

CINCINNATI®
GRINDING MACHINE DIVISION

INVOLUTE GEARS

FELLOWS

NON-INVOLUTE PARTS



Fellows
4GS Gear Shaper

GEAR SHAPERS DO DOUBLE DUTY

Fellows Gear Shapers are not limited to the production of gears alone. They are valuable production machines ideal for the manufacture of *many* types of parts, of both involute and non-involute form.

As gear shapers, they provide high production rates in the manufacture of internal and external spur and helical gears. As general purpose production machines, they also make possible the economical production of irregularly shaped parts . . . in many cases doing in one simple operation what would require several operations using conventional shop tools.

If you manufacture gears in your plant, chances are the Fellows Gear Shaper is already an important part of your production process. If you manufacture irregularly shaped parts, find out how the Fellows Gear Shaper can help you increase production and cut costs.

Your Fellows representative will be happy to give you further information on the complete line of Fellows production and inspection equipment. Ask him, or write direct.

THE FELLOWS GEAR SHAPER COMPANY
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THE PRECISION LINE

Fellows *Gear Production Equipment*

4500 pieces between grinds

....threading stainless steel on bar automatic

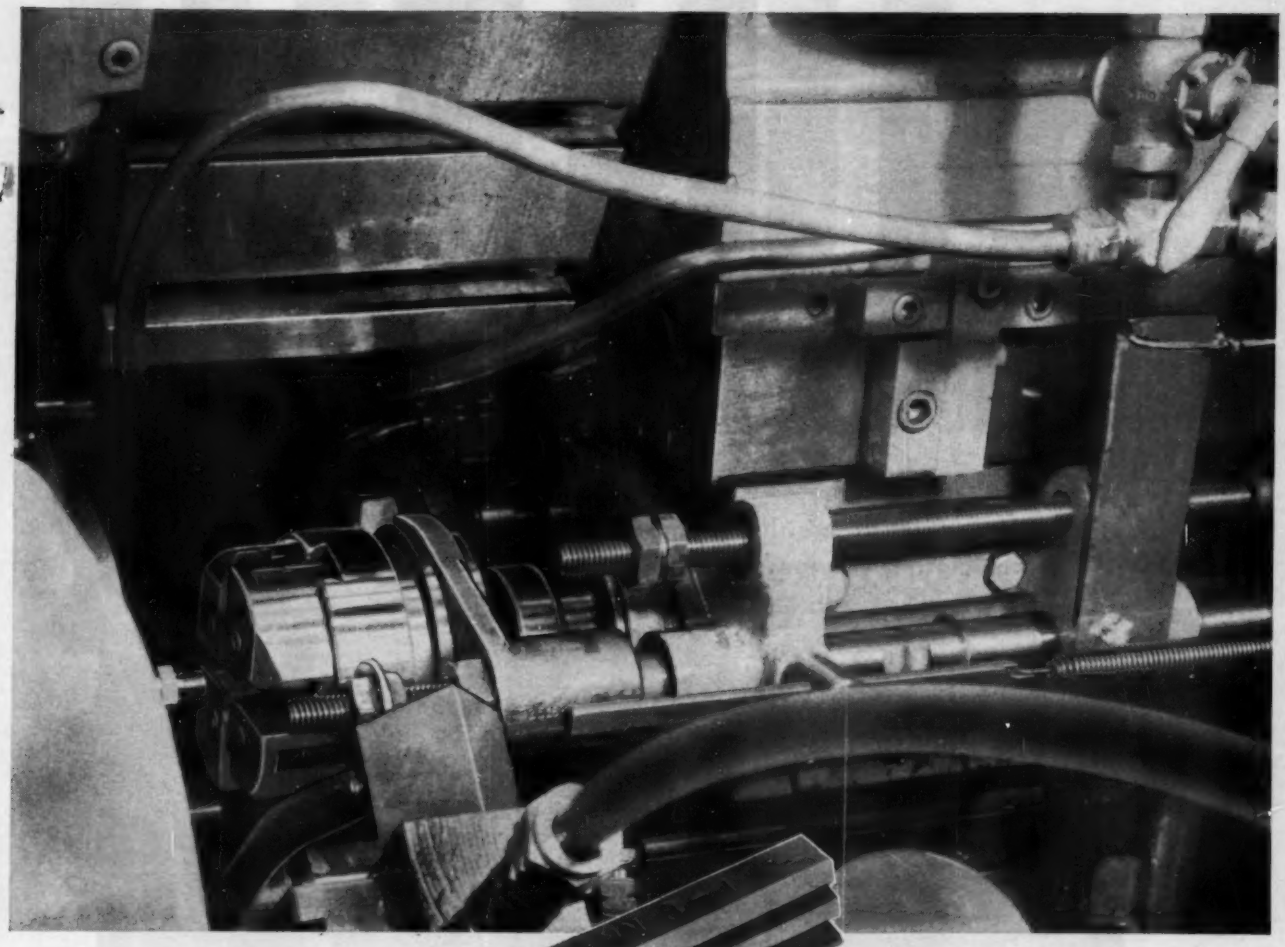
A LANDEX Hardened and Ground Die Head has maintained exceptional chaser life threading male connector tube fittings at the Crawford Fitting Co., exclusive user of LANDIS Equipment in Cleveland, Ohio.

7/16" 20 pitch UNF threads were cut to Class 3 fit from 316 stainless steel by a 7LLL Head mounted on a six-spindle Warner & Swasey Bar Automatic. The fittings were threaded 5/16" long within 3/32" of a shoulder at 19 to 20 SFM. 4500 pieces were produced between chaser grinds using 30° short throat chasers.

This outstanding tool life is the result of basic chaser design and over 50 years of LANDIS research and experience in manufacture and hardening. For example, to ensure satisfactory die life, chasers are given special hardening when workpiece design or material specifications so indicate.

Long life between grinds, as illustrated here at the Crawford Fitting Co., is one reason why the use of LANDIS Tangential Chasers ensures threading economy. It is further important to know that these chasers, requiring only a few thousandths metal removal to restore the cutting edge, are usable for 80% of their original length. In addition, it is not necessary to remove the same amount of metal from all chasers of a set, or to replace the entire set at the same time.

LANDEX Hardened and Ground Heads are unmatched for precision threading and true economy on bar automatics and other live-spindle machines with limited clearance. Let us show you how to improve threading operations—send specifications and ask for Bulletin F-80.



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a NEW

▲ New Landis 6" semi-automatic type R plain cylindrical grinder

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PRECISION GRINDERS

. . . now Landis offers the only new complete line of Plain and Universal Grinders with all these features. All new designs engineered for precision and production . . . not features hung on or added to an obsolete design.

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at eye level with turning handwheel during grinding feed for easier setup and operation

all NEW plain grinder truform dresser:
with both slides on preloaded balls for exact profiling

all NEW beds:
no hydraulic oil or open drains in bed—maintains better machine alignment

all NEW plain grinder footstock:
preloaded ball spindle for no shake and maximum stability

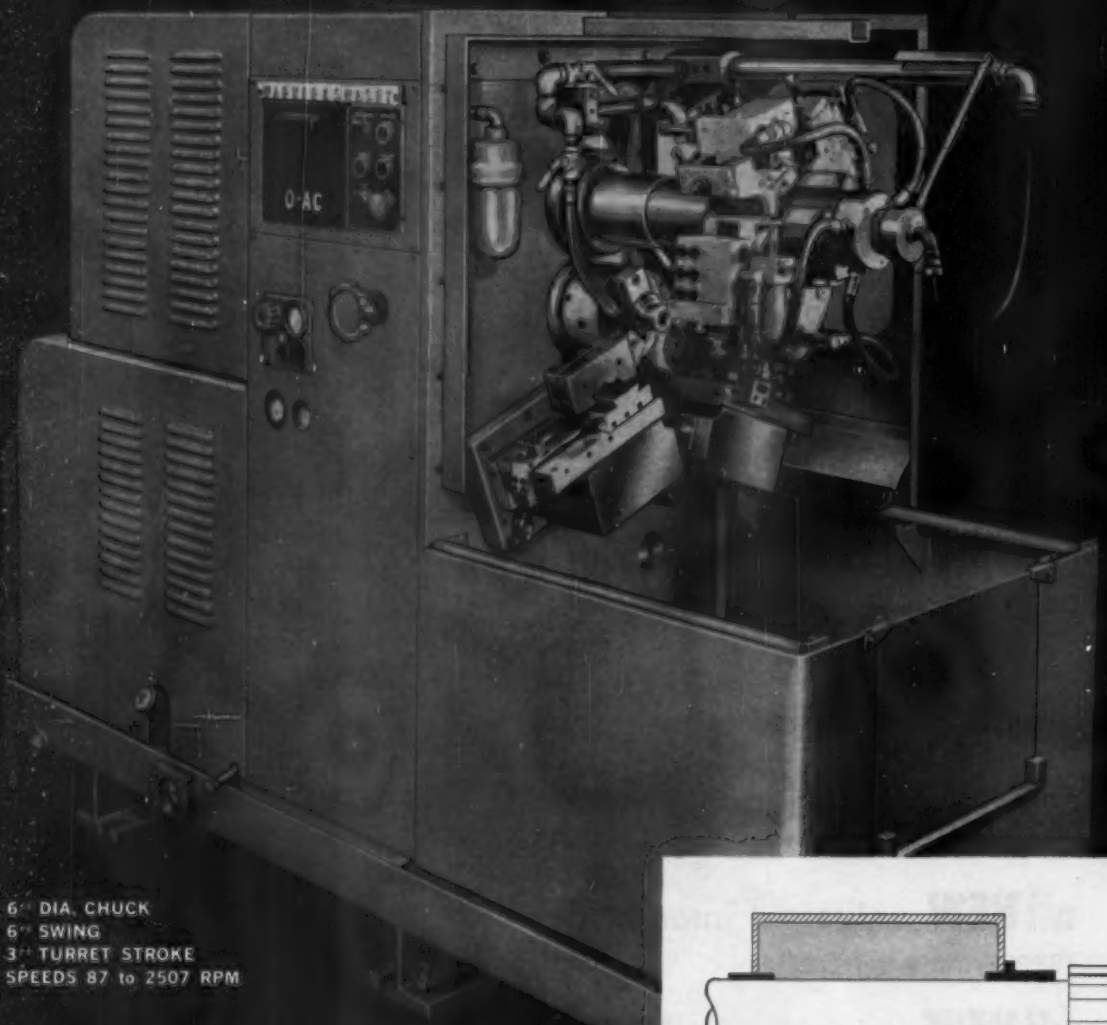
all NEW universal internal fixture:
compact, swing type—easy to position

all NEW universal feed:
for semi-automatic operation

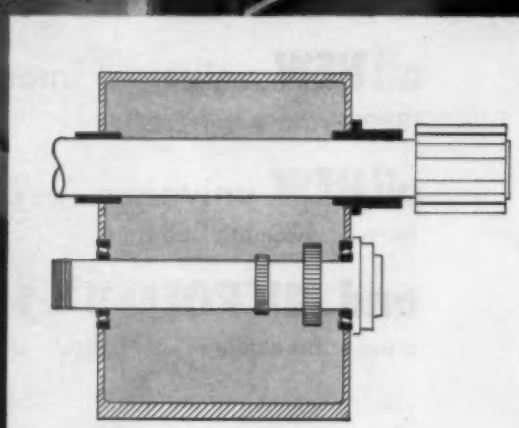
and MICROFEED®
a major breakthru in size control—available on these machines

LANDIS
precision grinders

NOW YOU CAN AUTOMATE PRODUCTION



6" DIA. CHUCK
6" SWING
3" TURRET STROKE
SPEEDS 87 to 2507 RPM



Spindle rise has been practically eliminated in the O-AC by placing the spindle and turret bearings in the same housing where they are subjected to exactly the same temperature, and continually lubricated with clean, filtered oil.

OF SMALL PRECISION PARTS with the New Warner & Swasey O-AC Single Spindle Chucking Automatic

Warner & Swasey's newest addition to its proven line of Single Spindle Chucking Automatics — the O-AC — is specifically designed to automate the production of small precision parts in all lot sizes — even as few as 30 or 40 pieces.

SMALL LOTS are profitable on the O-AC because it sets up fast and can be changed from job to job quickly and easily. There are no cams to design, change or store. The tooling area is uncluttered, easy to get to for faster cutter setting and adjustments.

PRECISION work piece tolerances and fine finishes on a repetitive piece-after-piece automatic basis are routine for this new single spindle chucker. Because of its unique overhead turret construction, only the O-AC can assure this high degree of production accuracy.

VERSATILE PERFORMANCE results from the O-AC's unique tool slide actions. A wide range of work — from ordinary small castings to complicated missile components — is efficiently handled, usually with low-cost standard tooling.

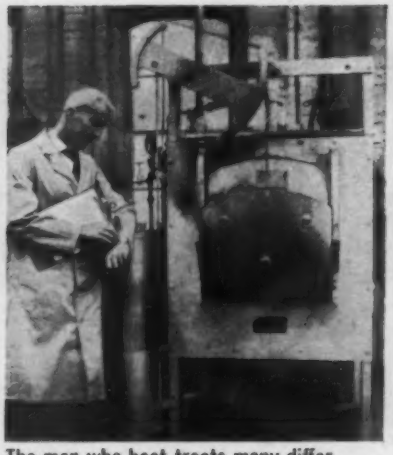
Your Warner & Swasey Field Engineer has the complete facts on the new O-AC ready for you. Or write us direct, Warner & Swasey Co., Cleveland 3, Ohio.

All automatic functions are rapidly set up by the simple placement of trip blocks and switch operating screws. All automatic functions can be individually hand controlled during setup and switched to "automatic" or back to "hand" at any time with a single control switch.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

NEW TOOL STEEL SERVICE

reduces heat treating costs

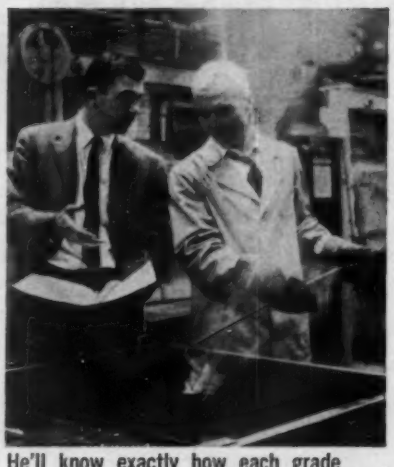


The man who heat treats many different tools

can realize major savings with Crucible's new Tool Steel Service.

He'll operate his furnaces more efficiently and profitably because

he'll now be able to heat treat many more tools at one time.



He'll know exactly how each grade responds to heat treating.

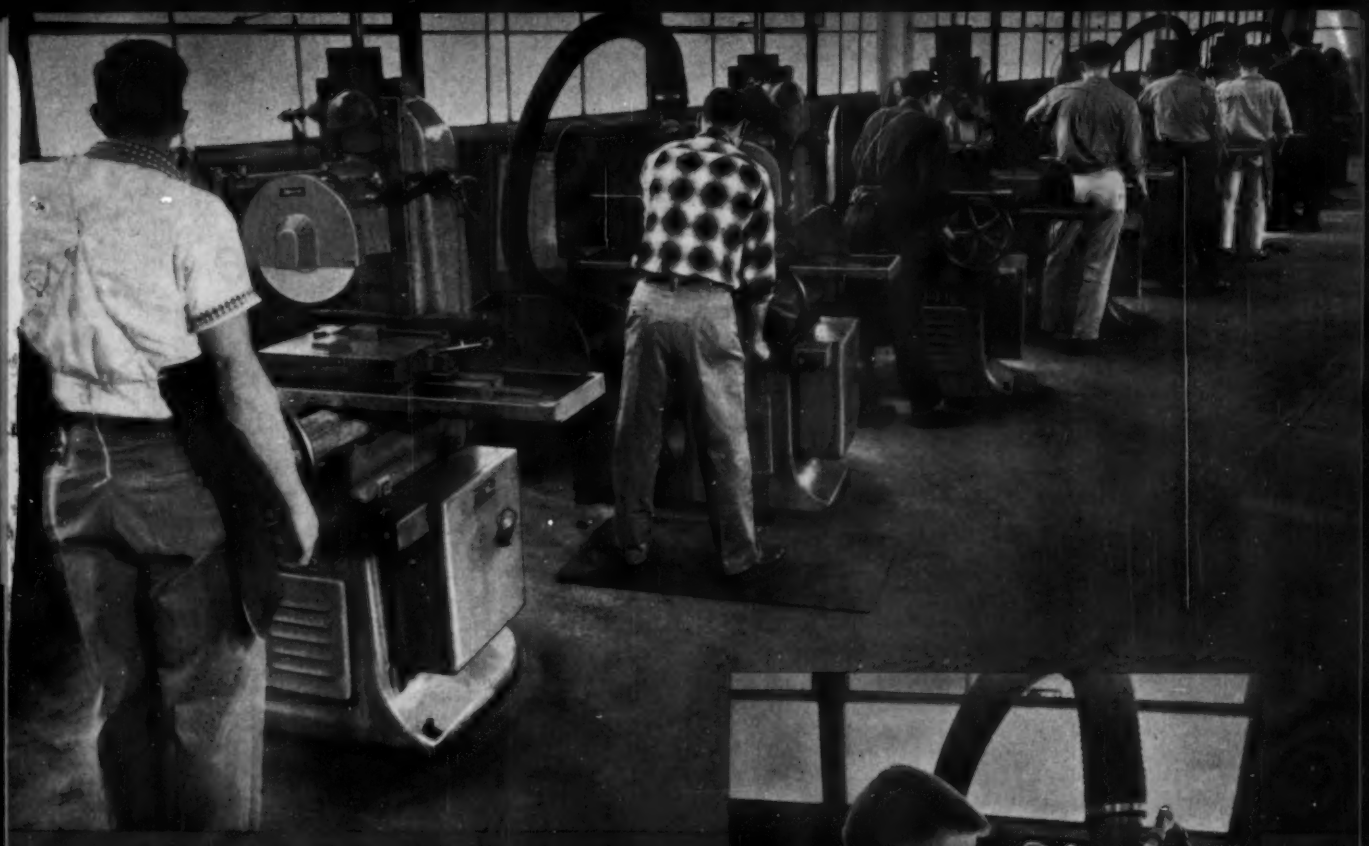
—so he'll certainly get more consistent results by employing time-tested techniques.

All by standardizing on a few basic tool steel grades!

To find out how this new Tool Steel Service can cut your heat treating costs, call in a CRUCIBLE Service Engineer.

CRUCIBLE STEEL COMPANY OF AMERICA

Branch Offices and Warehouses: Atlanta • Baltimore • Boston • Buffalo • Caldwell, N. J. • Charlotte • Chicago • Cincinnati • Cleveland • Columbus • Dallas • Dayton Denver • Detroit • Erie, Pa. • Grand Rapids • Houston • Indianapolis • Los Angeles • Miami • Milwaukee • Minneapolis • New Haven • New York • Philadelphia Pittsburgh • Portland, Ore. • Providence • Rockford • Salt Lake City • San Francisco • Seattle • Springfield, Mass. • St. Louis • E. Syracuse • Tampa • Toledo • Tulsa
CRUCIBLE STEEL OF CANADA, LTD., SOREL, QUEBEC, CANADA



Eight of twelve Landis Abrasive No. 1½ surface grinders at Glennie Industries, Inc., a precision tool and die manufacturer in Romulus, Michigan.

GLENNIE INDUSTRIES REPORTS:

"Faster than any other hand operated grinder" for grinding punches and dies

Grinding the nose contour of an interchangeable pad type punch to tolerances of ±.0001".

At Glennie Industries, where grinding is the largest operation, Landis Abrasive No. 1½ surface grinders maintain high standards of precision and production. For similar results in your shop, request a call by a Landis Abrasive surface grinder representative.

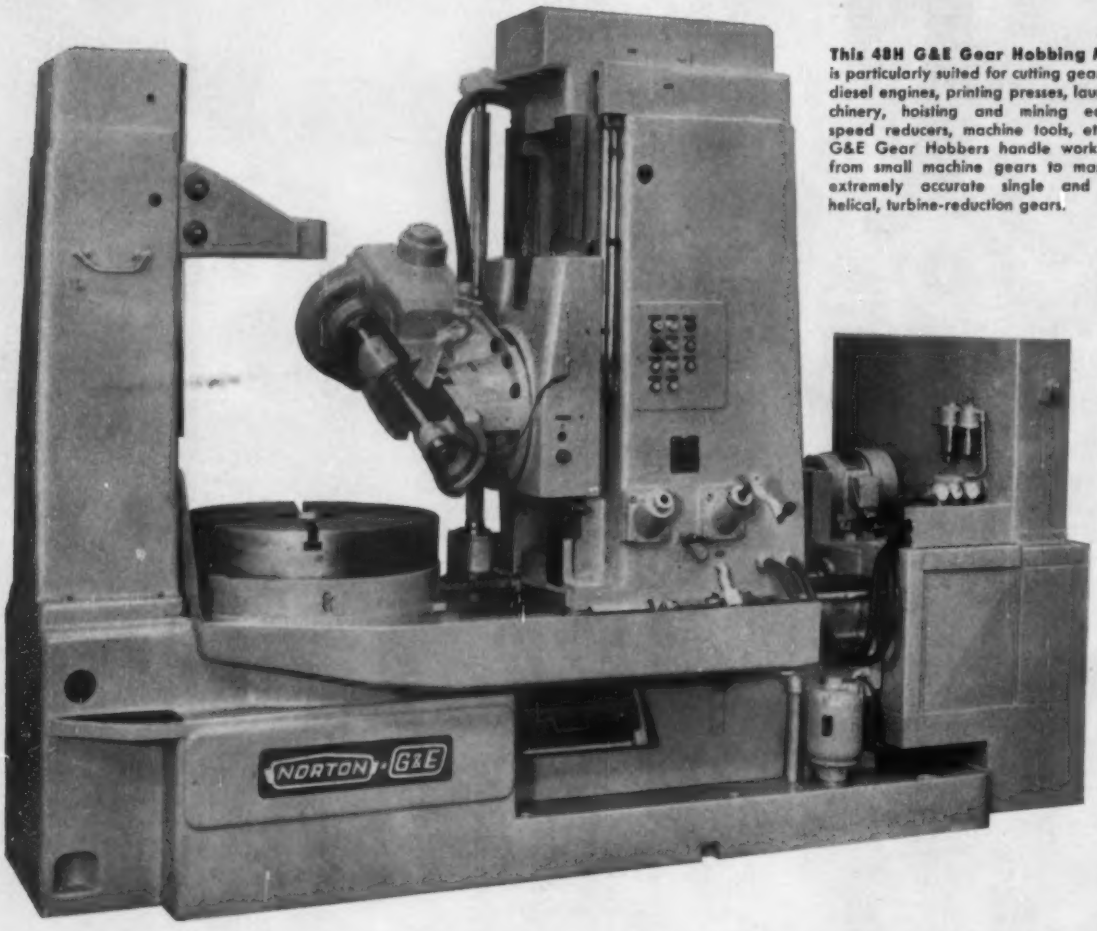
LANDIS

ABRASIVE

precision surface grinders

Landis Tool Company, Waynesboro, Penna.

How G&E gear hobbers combine high precision with high production...



This 48H G&E Gear Hobbing Machine is particularly suited for cutting gears used in diesel engines, printing presses, laundry machinery, hoisting and mining equipment, speed reducers, machine tools, etc. Other G&E Gear Hobbers handle work ranging from small machine gears to massive yet extremely accurate single and double-helical, turbine-reduction gears.

for your high profits

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

Gould & Eberhardt Universal Gear Hobbing Machines meet practically every industrial gear cutting requirement. Built for fast, dependable performance, they're established cost-cutters for rapid production of spur gears, single and double-helical gears, sprockets, splines, worm gears, worms, ratchets and special forms — in a wide range of pitches and diameters.

Highest production at lowest hob cost is assured by the highly developed vertical cutting principle, substantial hob support, gear trains and adjustment features.

And here's a fact it will pay you to remember:

The original productivity and accuracy built into hobbers by G & E is maintained at highest levels — and with every possible advancement — by the assimilation of G & E experience and personnel into the progressive and modern machine tool building operations of Norton Company.

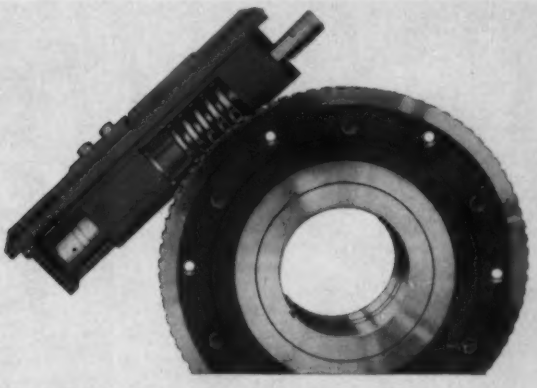
For careful help in selecting Gear Hobbers or other G & E equipment that will benefit your production see your G & E dealer or write to Norton Company, Gould & Eberhardt Division, Worcester 6, Massachusetts.

NORTON
MACHINE TOOLS

75 years of . . . Making better products
. . . to make your products better

HIGH PRECISION HIGHLIGHTS

Vertical Feed. Optimum accuracy is secured by a large diameter feed screw, precision-cut in a temperature-controlled laboratory and rigidly anchored in tapered, preloaded precision roller bearings. Backlash control is maintained by an easily adjusted two-piece bronze feed screw nut.



Indexing. DUALEAD® worm-gearing assures accurate indexing under heaviest production. The worm thread, with progressive variation throughout its length, simplifies adjustment by providing backlash control without change of center distance and insures uniform transmission of motion in both directions of rotations through proper conjugate tooth action, thus maintaining accuracy of index under high operating speeds and over an extended period.

The maximum wear-resistance quality of the mating chill-cast nickel bronze DUALEAD index worm gear results in minimum wear to maintain extreme accuracy longer.

HIGH PRODUCTION HIGHLIGHTS

Rapid, Precise Hobbing. Speed and accuracy for sustained high production rates — as well as extra-long service life of hobs and machines — are assured in G & E Hobbers because:

. . . The heavily proportioned, easily adjusted hob slide travels on double rectangular guides for sustained accuracy in basic motion.

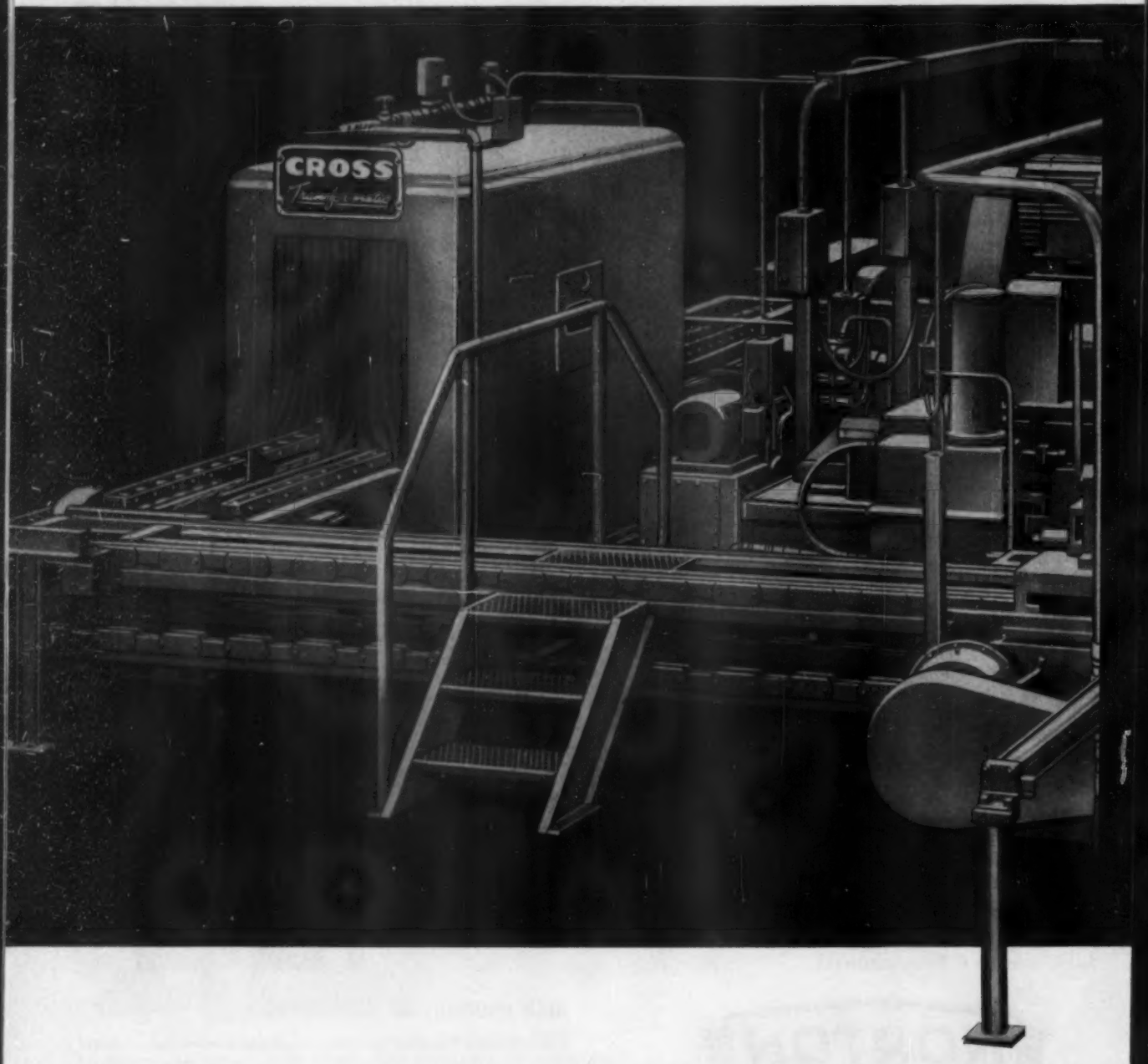
. . . The single-helical final-drive gear to the hob is independently mounted on large antifriction bearings to prevent compounding stresses on the hob spindle.

. . . The fixed-position work table is located in a large tapered bearing and supported by a flat annular bearing to absorb cutting stresses.

. . . The hob arbors are heat treated and chrome plated to reduce wear and eliminate the tendency to raise burrs which cause eccentricity and hob wobble.

MACHINE TOOL DIVISION: Grinding and Lapping Machines — G & E DIVISION: Shapers • Gear Cutting Machines • Gear Induction Hardeners

Completely Machines Tractor Axle Housings



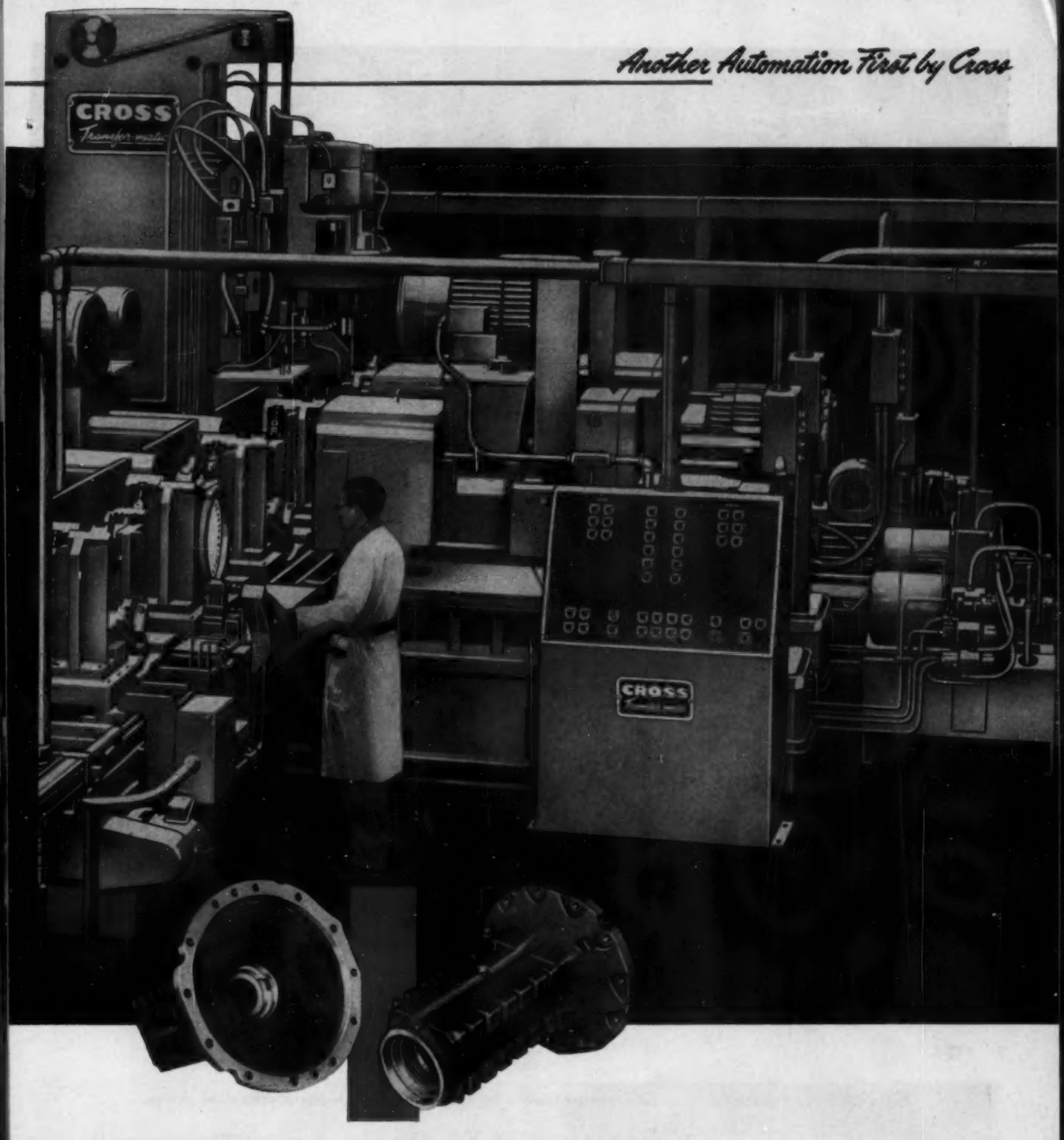
Assures Concentricity and Squareness of Bearing Seats, Counter-Bore and Mounting Flange

A significant breakthrough in processing of tractor rear axle housings has been accomplished by this new Transfer-matic which performs all machining operations.

An outstanding advantage of the machine is greater accuracy. Concentricity and squareness of the bearing seats, counter-bore and mounting flange are assured. Bore tolerances are ±0.0005. The concentricity, squareness, and center-distance tolerances between the bearing seats, faces and dowels is ±0.001. Close alignment between the two ends is maintained by doing all precision boring and the facing on both ends in one station.

CIRCLE 169 READER SERVICE CARD

Another Automation First by Cross



Four different housings weighing up to 175 pounds are processed with minor adjustments. Production requirements are up to 28 per hour for any of the four parts.

An unusual feature of the Transfer-matic is the use of two shuttle heads that index so that successive operations can be performed without moving the part. This design reduces the amount of capital investment required.

A Cross Sales Engineer will be glad to elaborate on these and other Cross developments.

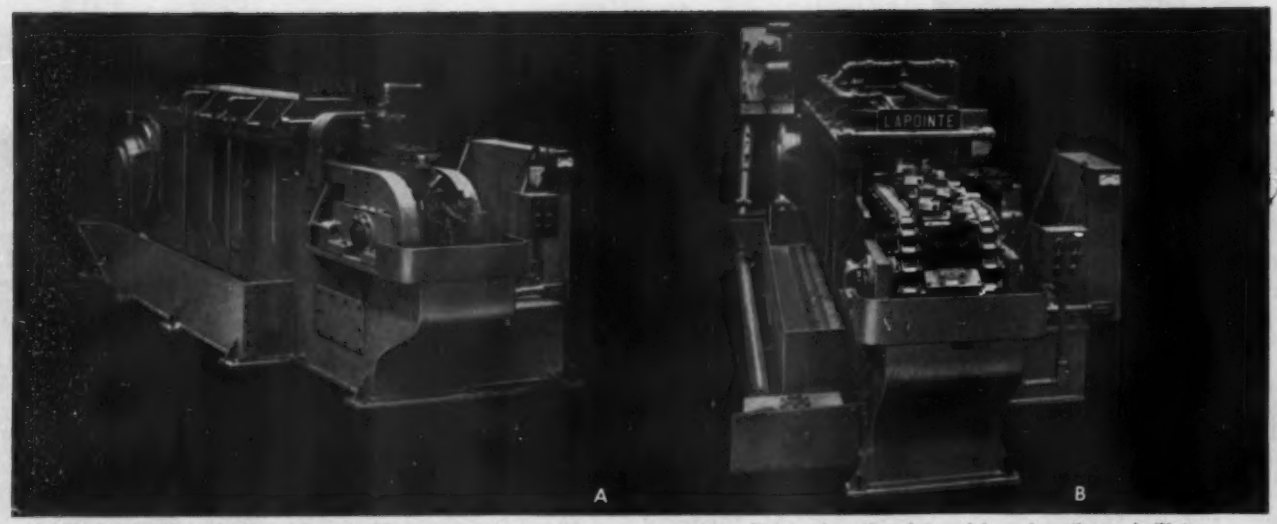
Established 1898

THE **CROSS** CO.

First in Automation

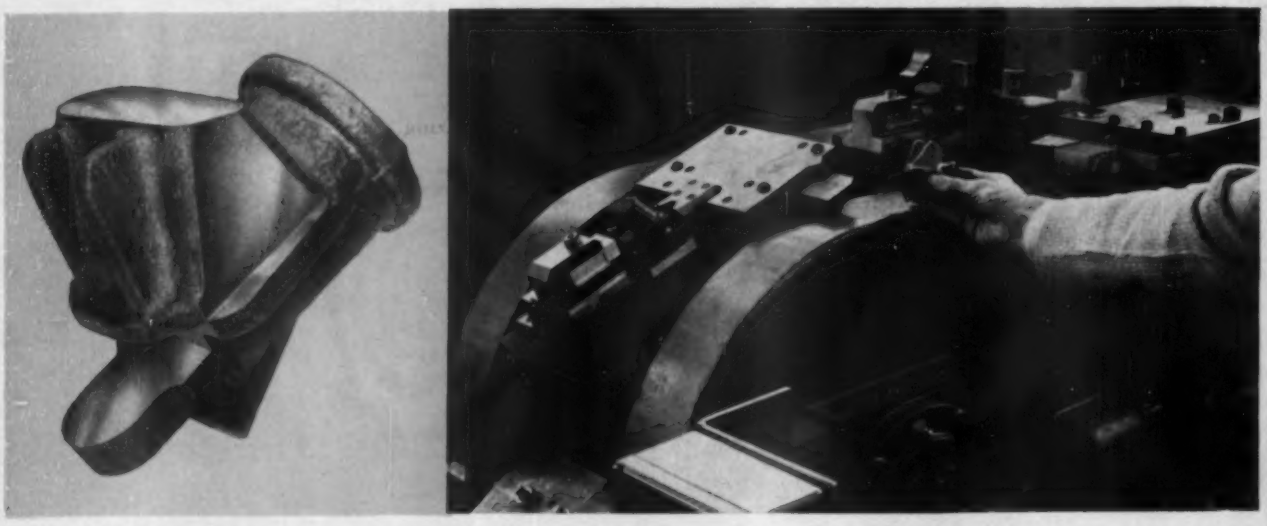
PARK GROVE STATION • DETROIT 5, MICHIGAN

CIRCLE 170 READER SERVICE CARD



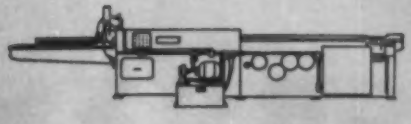
FIRST OPERATION (A) Broaching at 30 feet-per-minute, this machine straddle-broaches the two sides of the part. The machine is the LAPOINTE 20/66 Continuous-Broaching Machine.

SECOND OPERATION (B) This machine actually performs **two** operations: it broaches the slot and broaches the pad. (Note the different angles of the broached surfaces.) The machine is the LAPOINTE 30/120 Continuous-Broaching Machine. Both machines are equipped with automatic-clamping, self-ejecting fixtures.

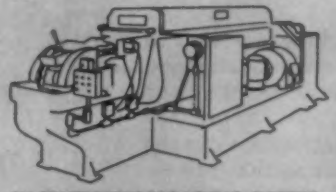


FRONT WHEEL BRAKE CYLINDER Production doubled (1200/hr., 3 seconds per piece!)
Tool life tripled (100,000 and more, pieces per grind!)
Quality up (formerly there was an abnormally high rate of rejects)

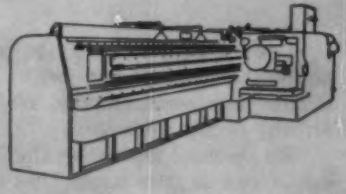
Lapointe-built Broaching Machines are available in hydraulic and electro-mechanical drives.



60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC

We've got **downtime** licked!

Imagine! . . . for tool changes, these two

LAPOINTE **CONTINUOUS**

BROACHING MACHINES

are down for a couple of hours only,

every three weeks!

- **Carbide Tooling** is part of the answer . . .
- **Heavy, rugged construction** is part of the answer . . .
- **Intelligent broach engineering** is the *main reason* for the amazing success of this and other Lapointe-Broaching applications.

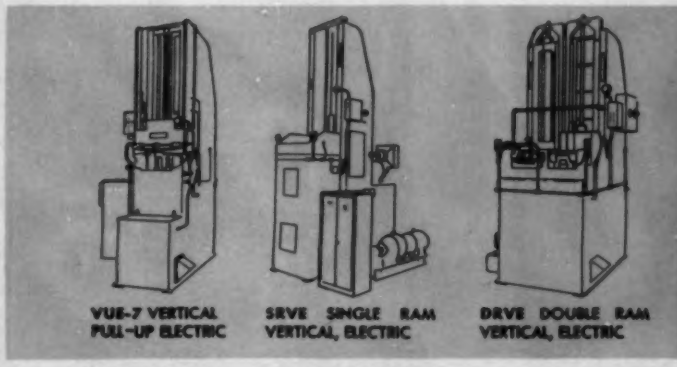
  Lapointe was the pioneer in the art of modern broaching, and has had nearly sixty years of experience in this field — longer than that of any other company.

  Production costs *can* be driven down . . . and Lapointe knows how to do it! We suggest that you invite an experienced Lapointe Field Engineer to discuss some of your production problems with you.

THE LAPOINTE MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES



VUE-7 VERTICAL PULL-UP ELECTRIC

SRVE SINGLE RAM VERTICAL, ELECTRIC

DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

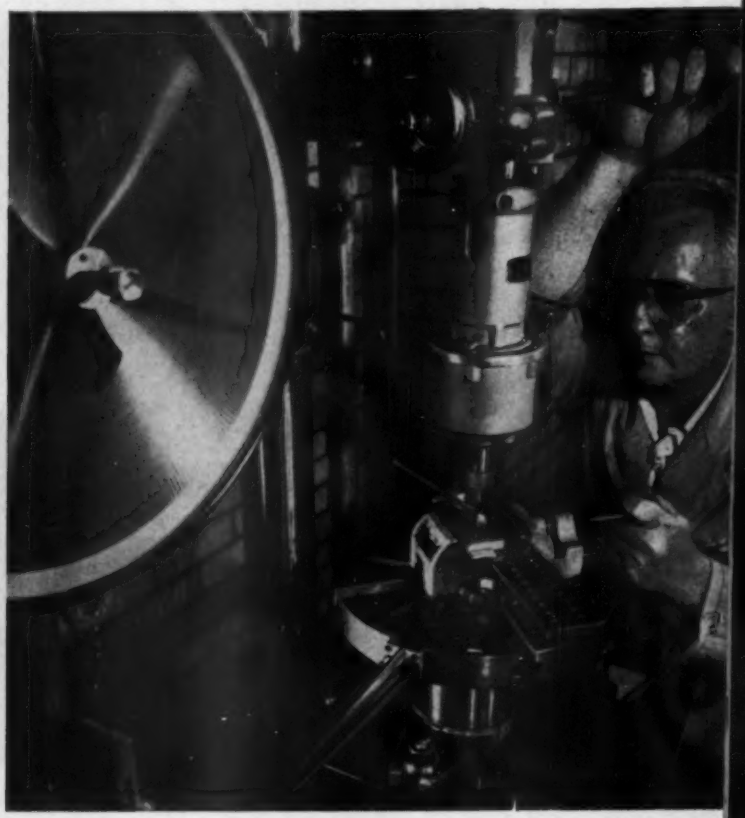
BROACHING

Announcing a major advance

Mobilmet Oils

the first multi-metal cutting fluids...
with unique pressure-temperature selective activity.

This Tapping Efficiency Tester is one of many Mobil research tools used in the development of cutting fluids such as Mobilmet . . . effectively evaluates the machining efficiency of cutting oils on soft, draggy SAE 1020 steel. On this difficult machining operation as well as in field service, Mobilmet oils have demonstrated results better than conventional cutting fluids intended for this application. Other applications for new Mobilmet oils include: Turning, Drilling, Boring, Milling, Gear Hobbing, Shaping and Shaving, Threading, Tapping, Pipe Threading, Surface and Internal Broaching, Thread and Form Grinding, Thread Rolling, Forming and Special Automatic Screw Machine Operations.



in cutting-oil technology...

Now... from Mobil Research... versatile new cutting fluids that offer you: • greater machine output • lower tool costs • reduced loss from rejects... over wide ranges of metals and operations!

Now, after two years of exhaustive research and field testing . . . new Mobilmet* oils—the first multi-metal cutting fluids ever offered to the metalworking industry.

Mobilmet oils are uniquely versatile . . . help simplify your cutting oil requirements because each grade is effective over ranges of metals and operations beyond the capacity of any conventional product. And Mobilmet oils offer you superior machining results as well—in terms of improved finishes, longer tool life, and reduced staining.

Behind this versatility and effectiveness: a new additive composition, developed and patented by Mobil, which is *pressure-temperature selective* in its activity—highly effective over the wide ranges of cutting pressures and temperatures produced in machining various metals with greatly different physical characteristics. As a result, Mobilmet oils are useful for both tough, draggy metals and hard, brittle metals.

Call your Mobil Representative, or use the coupon below.

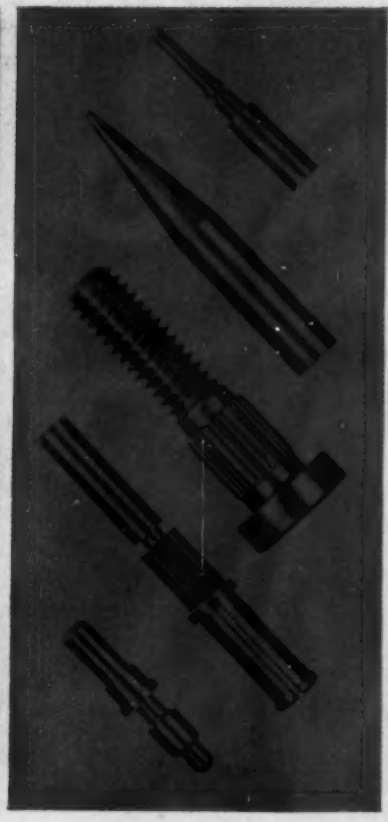
Mobil

*Mobilmet is a trademark of Socony Mobil Oil Company, Inc.

MOBIL OIL COMPANY, 150 East 42nd Street, New York 17, N. Y.

Mobilmet oils offer superior tool life on both soft, draggy metals and hard, clean-cutting materials. These pipe threading chasers used for six weeks in moderately severe job-shop service show little wear on either tool faces or thread crests. Results were achieved with heavy-duty Mobilmet oil.

Since they effectively control built-up edge and tool wear, Mobilmet oils provide superior finishes that meet exacting specifications—with fewer rejects, and in some cases reduced necessity for additional finishing operations.



Stain-inhibiting effect of new additive combination is demonstrated with two steel plates. Plate on the left was immersed in conventional corrosive cutting oil; plate on the right was immersed in heavy-duty Mobilmet grade intended for the same application. Re-polished tops of plates show original condition.

Mobil Oil Company, Room 2057-A
A Division of Socony Mobil Oil Company, Inc.
150 East 42nd Street, New York 17, N. Y.

Gentlemen: I am interested in learning how Mobilmet oils can improve metal-cutting operations at my plant. Contact me about setting up an evaluation program.

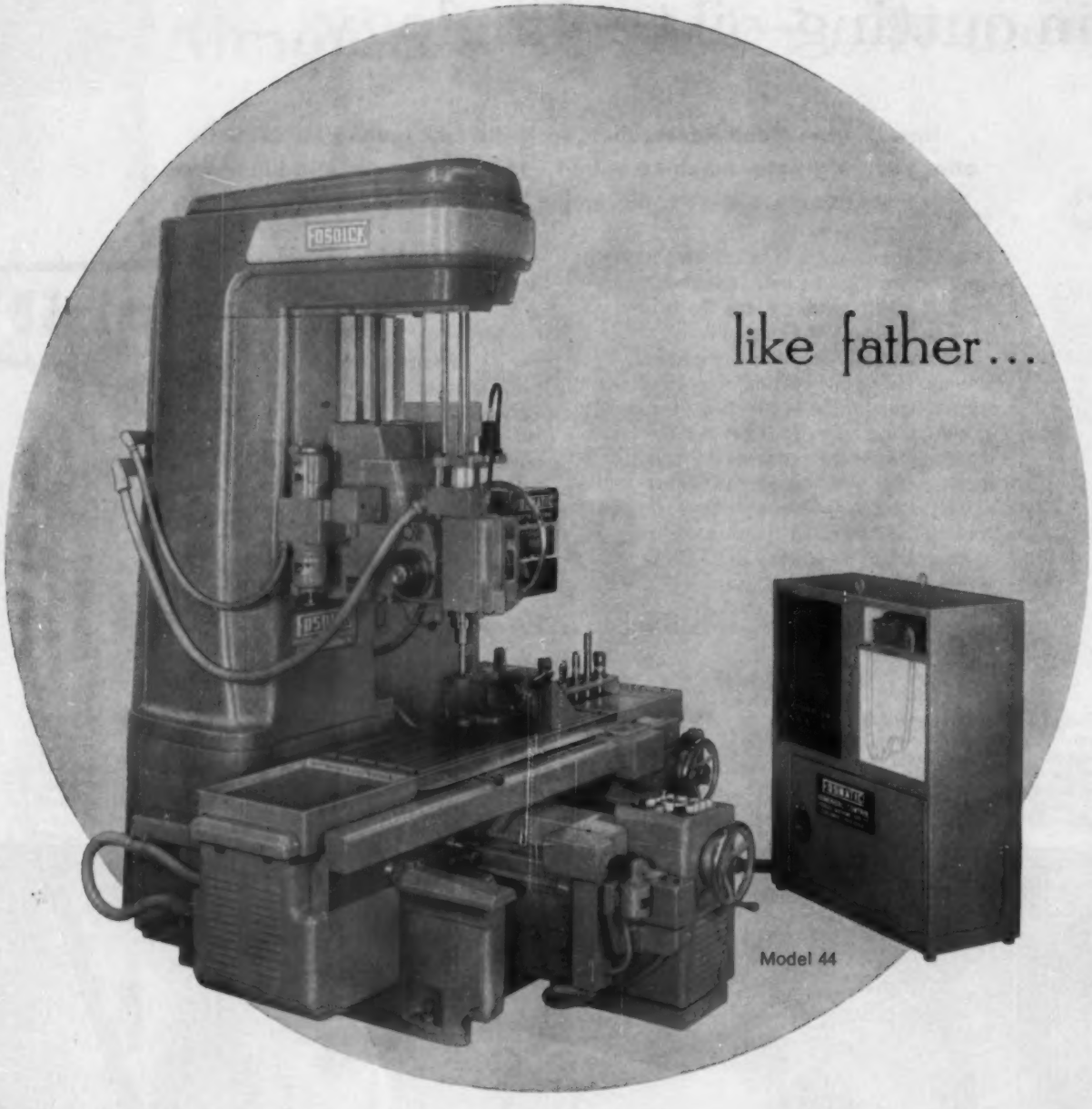
*Name*_____

*Position*_____

*Company*_____

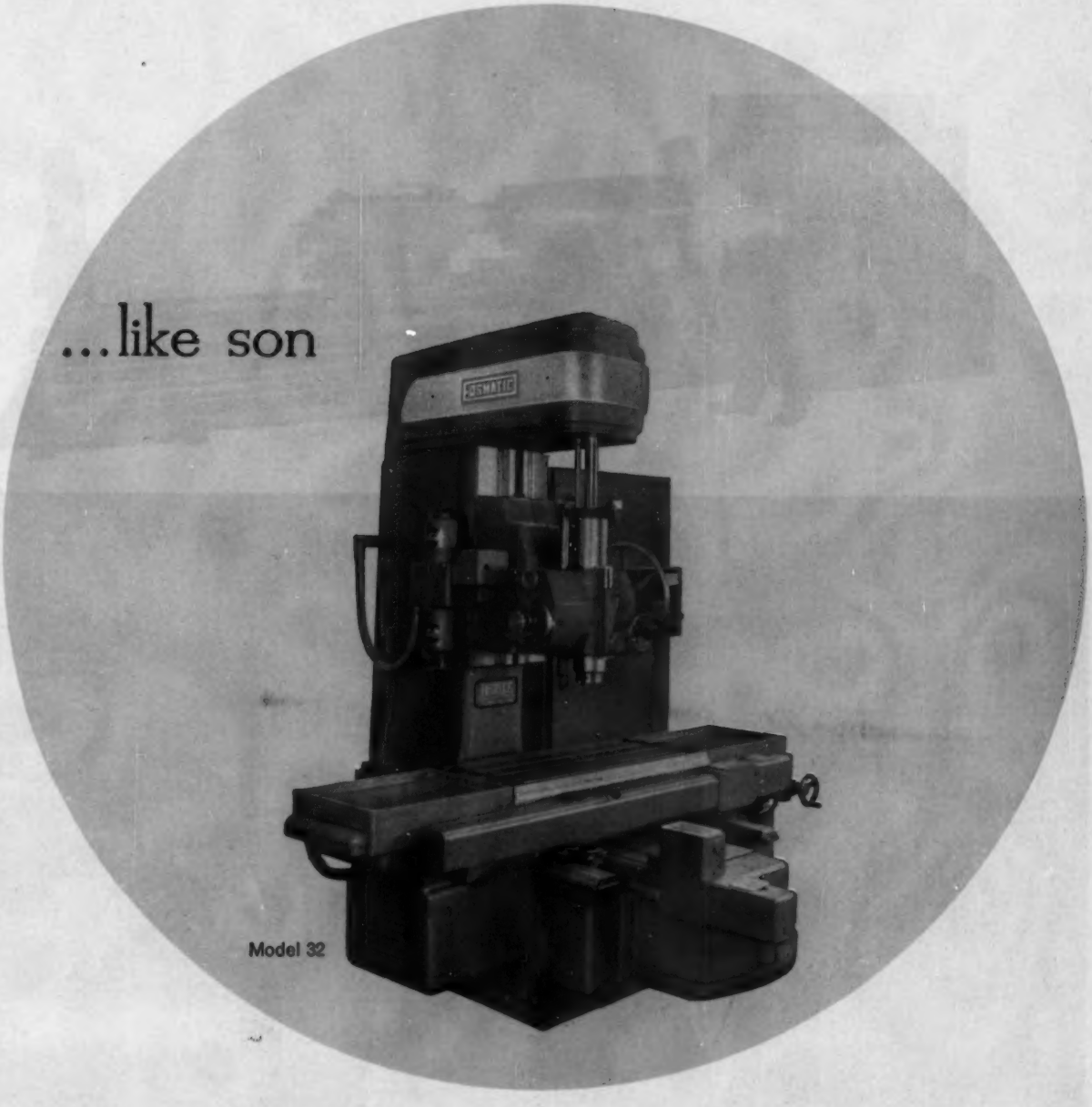
*Address*_____

*City*_____ *State*_____



Specifications	32	42	44	54
Table working surfaces	18" x 32"	18" x 42"	44" x 22"	54" x 22"
Table travel	18" x 30"	20" x 36"	22" x 42"	28" x 48"
Spindle nose to table top	4" to 22½"	4" to 28½"	6" to 30"	6" to 30"
Spindle center to column face	16½"	16½"	18½"	18½"
Spindle center to column throat	21"	21"	25¼"	30½"
Column throat to table top	16"	16"	22"	22"
Head travel on column	9½"	15½"	15"	15"
Spindle travel in head	9"	9"	9"	9"
Speeds	62-3000 rpm	62-3000 rpm	30-1800 rpm	30-1800 rpm
Feeds—inches per revolution	.0005 to .015	.0005 to .015	.0005 to .015	.0005 to .015
Motor	3 hp 1800 rpm	3 hp 1800 rpm	3 hp 900/1800 rpm	3 hp 900/1800 rpm
Floor space (without numerical control)	98" x 120"	98" x 134"	123" x 140"	134" x 156"
(numerical control console)	25" x 48"	25" x 48"	25" x 48"	25" x 48"
Net weight	10,000 lb.	11,000 lb.	21,500 lb.	23,500 lb.

...like son



Model 32

New Compact Jig Borers

Like father like son, the same features that made the reputation of the big Fosmatic 44 and 54 Precision Boring Machines are now available in two smaller size machines, the Model 32 with 18″ x 30″ table travel, and the Model 42 with 20″ x 36″ table travel.

These completely new machines are ideal for boring jobs on missile parts and similar delicate jobs that require extreme accuracies. The 32 and 42 are equally at home on jig-boring jobs in the toolroom, or on extended production runs.

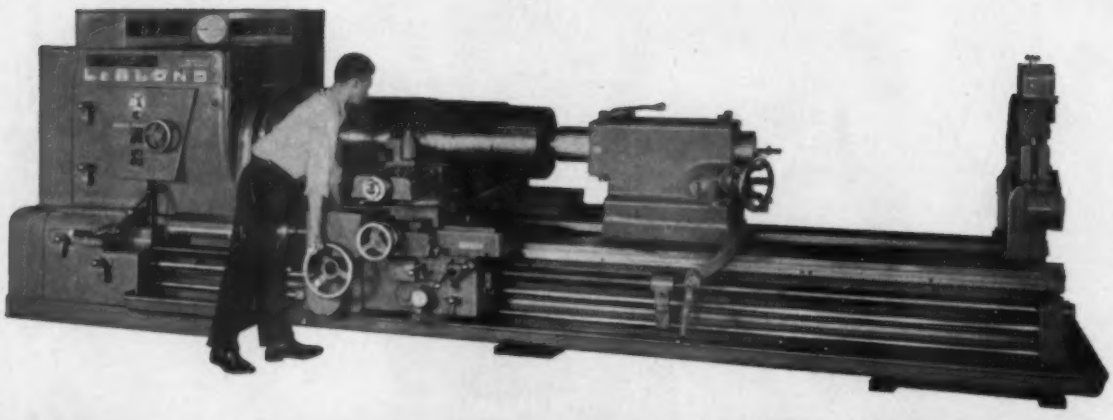
Like the big Fosmatics, they offer direct dimension measuring for establishing locations quickly by direct-reading dials. They also give you automatic positioning that brings table and saddle into location at the touch of a button to accuracies of ±.0001″. Push-button control of speeds and feeds is standard on both jig borers.

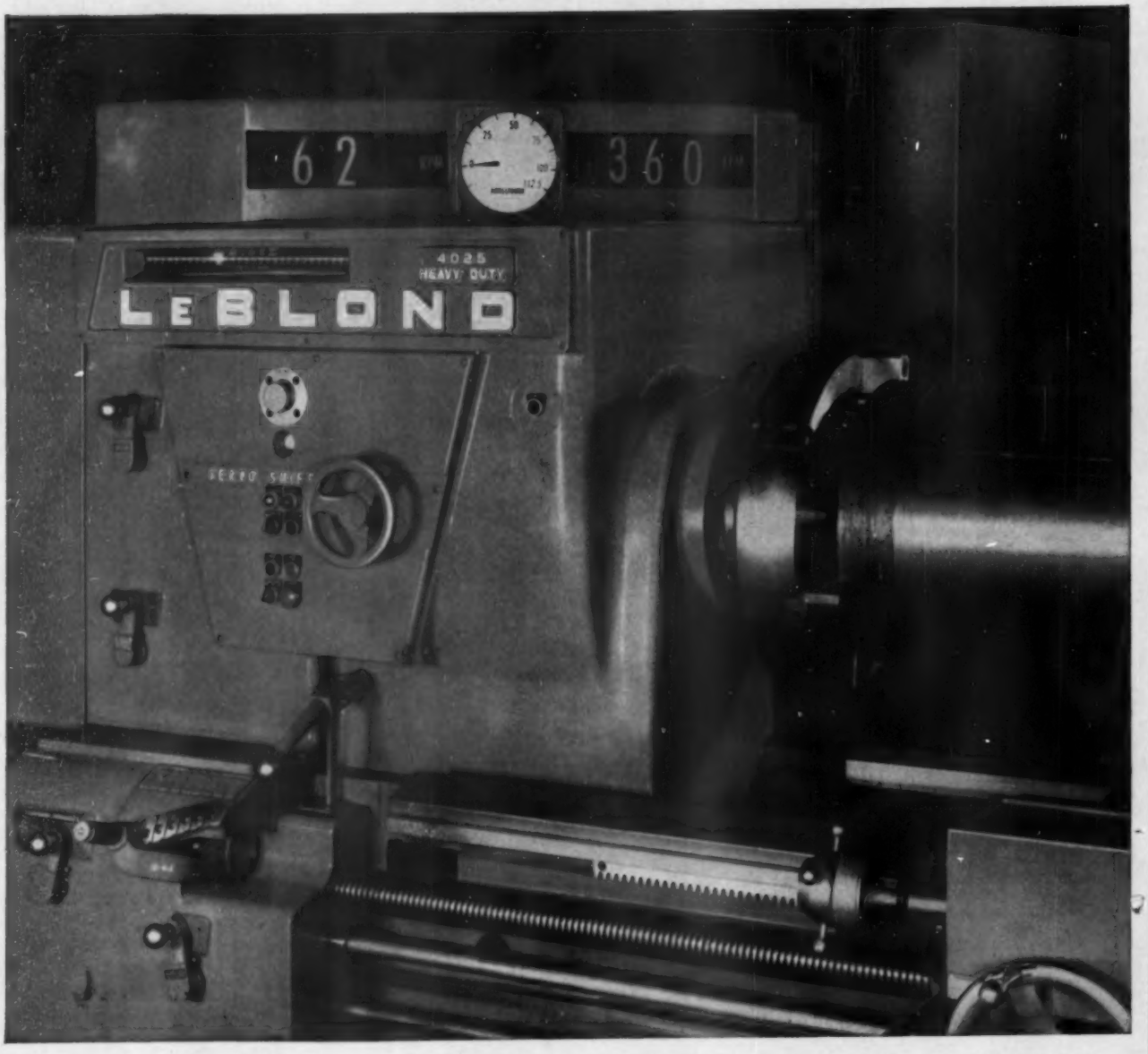
Numerical control? Absolutely! The same full Fosmatic numerical control in three dimensions, outstandingly successful on big 44 and 54, is also available on the 32 and 42.

If you have been wishing for a smaller machine with the big Fosmatic features, then the 32 and 42 are just what you asked for. Call your Fosdick distributor to learn more about these two new members of our family. And get a proposal from Fosdick!

FOSDICK

THE FOSDICK MACHINE TOOL CO.
CINCINNATI 23, OHIO


LEBLOND

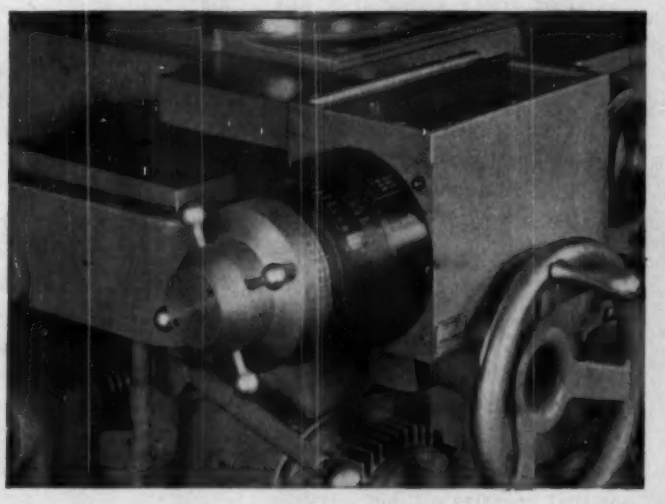

62
360
4025
HEAVY DUTY
LEBLOND

THE R. K. LeBLOND MACHINE TOOL CO. *World's Largest Builder of a Complete Line of Lathes*
Cincinnati 8, Ohio

LeBLOND of Cincinnati

SERVO-SHIFT BY LeBLOND

More Production with Less Effort



You'll never need an operator with blacksmith muscles and an adding machine mind!

TOUCH A BUTTON on the carriage: This new LeBlond 4025 Heavy Duty slows, shifts, and picks up speed again in a new gear range, automatically. That's Servo-Shift doing the heavy work. No running to the headstock. No straining at balky levers. No wasted time.

TURN THE DRUM DIAL on the carriage to preselect spindle speed or surface speed. Set one, you automatically get the other for any diameter, fed in automatically from the gear train and cross slide position. No slide rules needed. No calculations. No errors.

BIG ILLUMINATED NUMBERS—Digital Readout—show sfm and rpm atop the lathe where everybody can see what's going on. No question now about when to push the Servo-Shift button for the next speed range. This readout tells. You get the cutting rates you specify. Rates you can plan on.

IT'S ALL NEW, right down to the sensible bed that slides chips out the back for easy clean up, and the remotely shifted gear train that provides 36 speeds in geometric steps from 5 to 600 rpm—6000 sfm at the periphery of a 40″ diameter workpiece. Everything's safety interlocked by a closed loop system to prevent any chance of gear damage, important with 75 hp.

And under the electromechanical wizardry, this LeBlond 4025 (and other models to come) is as fine a heavy-duty lathe as money can buy. You'll assign it the big work, heavy shafts, roll turning jobs with or without a LeBlond 90° tracer, and you'll value the way it speeds production. Ask your LeBlond representative about the LeBlond 4025 Servo-Shift today.

Why every metalworking plant should own a Barber-Colman numerically controlled lathe

This 16-inch swing lathe combines greatly simplified numerical control . . . low cost . . . and versatility to fit any shop that has short-run jobs, either step or taper turning. It is a completely flexible general-purpose machine—designed for rapid change-over and economical job-shop operation.

The Tape-r-guide, as you can see it at bottom of page, is one complete package. There is no freestanding console. The reader is in the headstock, and all other controls are in the rear panel.

Here is a dramatically different approach to numerical control . . . one that operates without intricate memory units . . . one that is simple enough to gladden the heart of every maintenance man *and comptroller.*

For example, there are only two thyratron tubes in the Tape-r-guide, and these are of a long-life, extra-duty type, guaranteed for two years. Except for these, and some common solenoids and relays, controls consist entirely of solid-state circuits. On-off devices have been used wherever possible. There is no quantitative requirement on electrical functions. There is no critical voltage level that would permit an off-size dimension and a scrapped piecepart. Basically mechanical actuation means you have a lathe that is easy to live with, has more time to cut metal.

Despite its extreme simplicity, Barber-Colman Tape-r-guide provides every one of the operating, control, and setup advantages you normally expect from the more complex tape-control systems. That's because it is designed specifically for its application and is incorporated right into the lathe. Handwheels and manual control levers are used for setup only.

Both axes always under direct control

All stop-start, positioning, speed adjustment, and feed change functions are controlled automatically from eight-channel binary code tape. Simple radii may be formed under tape control, using standard single-point tools. Both axes are continuously under precise and *direct* control. By

It pays for itself quickly on short-run step and taper turning jobs. You cannot buy the same capabilities in other lathes for anywhere near the price. And it's the simplest numerically controlled lathe to program, set up, operate, and maintain.

feeding both carriage and cross slide, the machine will cut accurate, discrete tapers having included angles from 2° to 172°. There is no feedback.

This machine will do your jobs faster than a tracer lathe because it relieves the operator more completely of size control, machine speed, operating, and setup responsibilities. Setup is faster and foolproof. Tools are preset off the machine for fast changing.

Now, you can eliminate the cost and inflexibility of templates and special tooling. Job programing and tape punching can be done for a small fraction of the cost of making templates. In short, the Tape-r-guide gives you more control and greater production than a tracer lathe—yet amazing simplicity takes it out of the price class of most numerically controlled machine tools.

System resolution is within ± .001" on diameter and length, but the machine itself is mechanically capable of even finer work. You can turn chamfers without special tools—perform cutoff, boring, drilling, and reaming operations, as well as internal and external step-turning. Antifriction ball screws and nuts increase sensitivity of the carriage and cross slide—you get fast, accurate response to every command.

Even the coding is simple

The Barber-Colman coding system is simple, which saves time in data processing. It is based on the binary system of numbers, designed expressly for engine lathe operations. There are only five alpha-type designations for the commands. Just one row on the tape completes an axis command . . . only a few rows are required for each complete command sequence.

Numerical control begins at the first point of operation of the tool, rather than from an absolute zero point. After reading the command, the machine executes instantly. Elimination of intermediate data storage reduces equipment cost and permits more efficient lathe design.

The Tape-r-guide produces fine finishes and precision tolerances—fast. It has large swing capacities (16" and 20"), infinite selection of spindle speeds to 1200 rpm, rapid traverse of the cross slide and carriage, and rugged frame castings made of dense Meehanite metal.

Ask your Barber-Colman representative for details on the "universal tooling" economics of Tape-r-guide numerical control.

Barber-Colman Company

BARBER COLMAN

111 Loomis Street, Rockford Illinois

MORSE MAKES MILLIONS FOR PHILCO

. . . millions of tiny holes—precision-drilled by rugged, long-life Morse "Electrolized" Tools for Philco's fabulous Transac.

It's the world's first large-scale all-transistor computer – Philco's new Transac S-2000. Among its components: 18,000 printed circuit cards of epoxy resin glass fiber – highly abrasive, excessively wearing on the tools that have to drill hundreds of tight-tolerance holes in each card.

Philco uses the tools that are armored for rugged action: Morse "Electrolized" drills. More durable than high speed steel . . . more flexible than carbide . . . savers on down-time, replacement.

Morse will help you, too. Tell your cutting tool problem to your Morse-Franchised Distributor. He's the man with the answers.

MORSE

means "THE MOST" *in Cutting Tools*

MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASSACHUSETTS

Warehouses in: NEW YORK • CHICAGO • DETROIT • DALLAS • SAN FRANCISCO

Morse means more production . . . smoother, more accurate production . . . with every type of cutting tool from drills, reamers, taps and dies, to end mills, milling cutters, slitting saws and "specials". So, if you want the best from every cutting tool you buy, mark your order "MORSE". For if you want *Morse Quality*, there's only one way to get it . . . *specify Morse.*

VN

A Division of VAN NORMAN INDUSTRIES, INC.

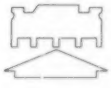
CIRCLE 181 READER SERVICE CARD ▲

CIRCLE 182 READER SERVICE CARD ►

When you think of PRECISION

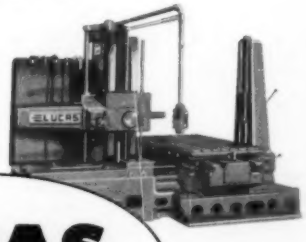
For life time precision Lucas provides

airlift to saddle

and table. 

These elements are supported on a thin film of lubricated compressed air during traverse. This separation of metal from metal virtually eliminates wear. During machining cycles the saddle and table are automatically clamped down tight to provide absolute rigidity for even the heaviest cuts. Unclamping is automatic, too. These are two aspects of Lucas design which contribute to the precision of these machines. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of Precision . . .

think of . . .



LUCAS
PRECISION

When you think of RELIABILITY

Lucas automatic power positioning

automatically repeats

automatically repeats

automatically repeats

to ±.0001 . . .

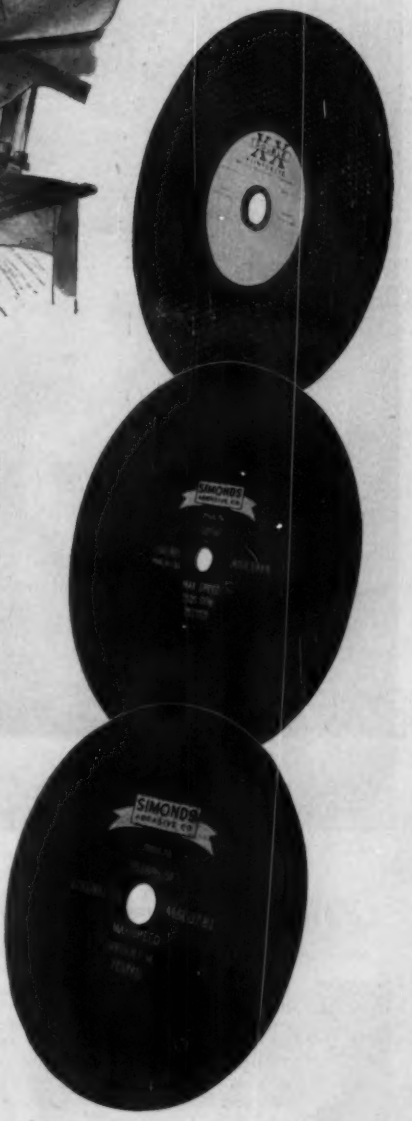
A simple, completely reliable system of dial indicators, end measures, and electrical controls automatically disengages rapid traverse, engages the fixed, constant-rate power feed and precision stops the unit at predetermined settings. Automatic power positioning assures the highest order of repetitive accuracy with an absolute minimum of operator attention.

A new catalog describes our complete line of horizontal boring, drilling and milling machines. Write Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland, Ohio. When you think of Reliability . . .

think of . . .

steel bars, tubes, angles, etc. . . . cast iron, bronze, brass

cut them fast and cut your costs with SIMONDS CUT-OFF WHEELS



For cutting metals *and* costs, use these abrasive wheels. They are just about the quickest, most efficient way to cut all kinds of metal and non-metals, and, since Simonds makes them in all grain, grade and bond combinations, you are sure of getting the ones exactly suited to *your* needs.

Regular Resinoid bonded for the rigors of high speed operation. Borolon (aluminum oxide abrasive) for steel bars, tubes, angles, etc. Electrolon (silicon carbide) for cast iron, bronze, brass and non-metals.

Reinforced Resinoid bonded for added strength. Hot pressed "BFN" type for foundry work . . . Double XX type, glass fiber reinforced on both sides, for cutting all metals and non-metals (except wood), including masonry blades.

Regular Rubber bonded for wet or dry grinding. Ideal for cutting all materials under stress and strain. Because of their clean-cutting action, finishing operations can be eliminated.

Reinforced Rubber bonded for extra safety. For swing-frame cutting on gates, risers, etc. Available wtih (1) Standard Reinforcement; fiber glass on both sides (2) Double Reinforcement; reinforced internally in addition to both sides, or (3) Triple Reinforcement; two internal reinforcements in addition to both sides.

Write for informative bulletins.

SIMONDS ABRASIVE CO.

PHILADELPHIA 37, PENNA.

COUNT ON / YOUR SIMONDS DISTRIBUTOR / FAST SERVICE • LOCAL STOCKS

WEST COAST PLANT: EL MONTE, CALIF.—BRANCHES: CHICAGO • DETROIT • LOS ANGELES • PHILADELPHIA • PORTLAND, ORE. • SAN FRANCISCO SHREVEPORT — IN CANADA: GRINDING WHEELS DIVISION, SIMONDS CANADA SAW CO., LTD., BROCKVILLE, ONTARIO • ABRASIVE PLANT, ARVIDA, QUEBEC

Reversing Ram Makes Die Changes Easy

This ruggedly built press is an operator's delight. It is provided with a reversing ram drive which permits backing the ram or upper die away from the work at any point in the stroke.

Since parts are produced in small quantities on this press, the dies and machine settings usually must be changed many times during a day. The reversing ram and other fine features make this work easy and fast for the operators.

This press is rated at ½" x 14'-0" mild steel but will bend plate to 18'-6" long that can clear the 18" deep throat.

No Other Shear Has So Many Important Features

Operators in hundreds of plants all over the country have acclaimed the ease of operation of Steelweld Shears. They like them because they have features that ease their work and make for accuracy. Steelweld is the **only** pivoted-blade shear on the market. No other shear has the wonderful MICRO-SET knife adjustment. Every Steelweld Shear is provided with fatigue-reducing electric foot switch control as standard equipment.

This shear is rated at 10' x 1".

Inquiries Invited for:

- Shears
- Bending Presses
- Single-Point Presses
- Two-Point Presses
- Four-Point Presses

Single and double action types

- Air Cushions

Operators LIKE STEELWELD MACHINES

THE MAN who operates a machine day in and day out usually gets to know it pretty well. If he has worked on various make machines, he is in a position to compare. He knows the good as well as the weak points. He can tell you what machines make his job easiest, what produce the most, what require the least maintenance. We have great respect for the operators and listen to what they say.

What we have been hearing about Steelwelds has elated us greatly. Briefly it is this: The operators have high regard for Steelwelds. They like their ease of operation which leaves them fresher at the end of the day. They approve the various adjustments with which Steelwelds are equipped and the simplicity of making them. They applaud the fact that the machines will operate continuously for long periods without need of attention.

The combination of the above factors, namely: Ease of operation, high production, excellent performance, and low maintenance, is hard to beat and accounts for the ever increasing popularity of Steelweld Presses and Shears.

GET THESE BOOKS!

Catalogs No. 1010 (Presses) and No. 1011 (Shears) give construction and engineering details. Profusely illustrated. Sent free.

Steelweld Machinery Division

THE CLEVELAND CRANE & ENGINEERING CO.

1458 East 281st S t. Wickliffe, Ohio

STEELWELD

PRESSES and SHEARS

BUILD IN STRENGTH AND LIGHT WEIGHT WITH N-A-X FINEGRAIN STEEL

In a wide variety of applications N-A-X FINEGRAIN—a low-alloy high-strength steel—can bring important weight savings without sacrifice of strength and safety. When you design N-A-X FINEGRAIN into your product, you get *all* these advantages:

- It is 50% stronger than mild carbon steel.
- Polishes to a high luster at minimum cost.
- Can be cold formed readily into difficult stampings without surface disturbances.
- Is stable against aging.
- Has high fatigue life with great toughness.
- Has greater resistance to wear and abrasion.
- Is readily welded by any process.
- Offers greater paint adhesion.
- Has twice the resistance of carbon structural steel to normal atmospheric corrosion.*

*Where greater resistance to extreme atmospheric corrosion is important, our N-A-X HIGH-TENSILE is recommended.

Sound like something for you? A thoroughly competent metallurgical service organization is available to work with you on any application problem you may have. Write, wire or phone Product Development Department, Great Lakes Steel Corporation, Detroit 29, Michigan.

N-A-X FINEGRAIN STEEL

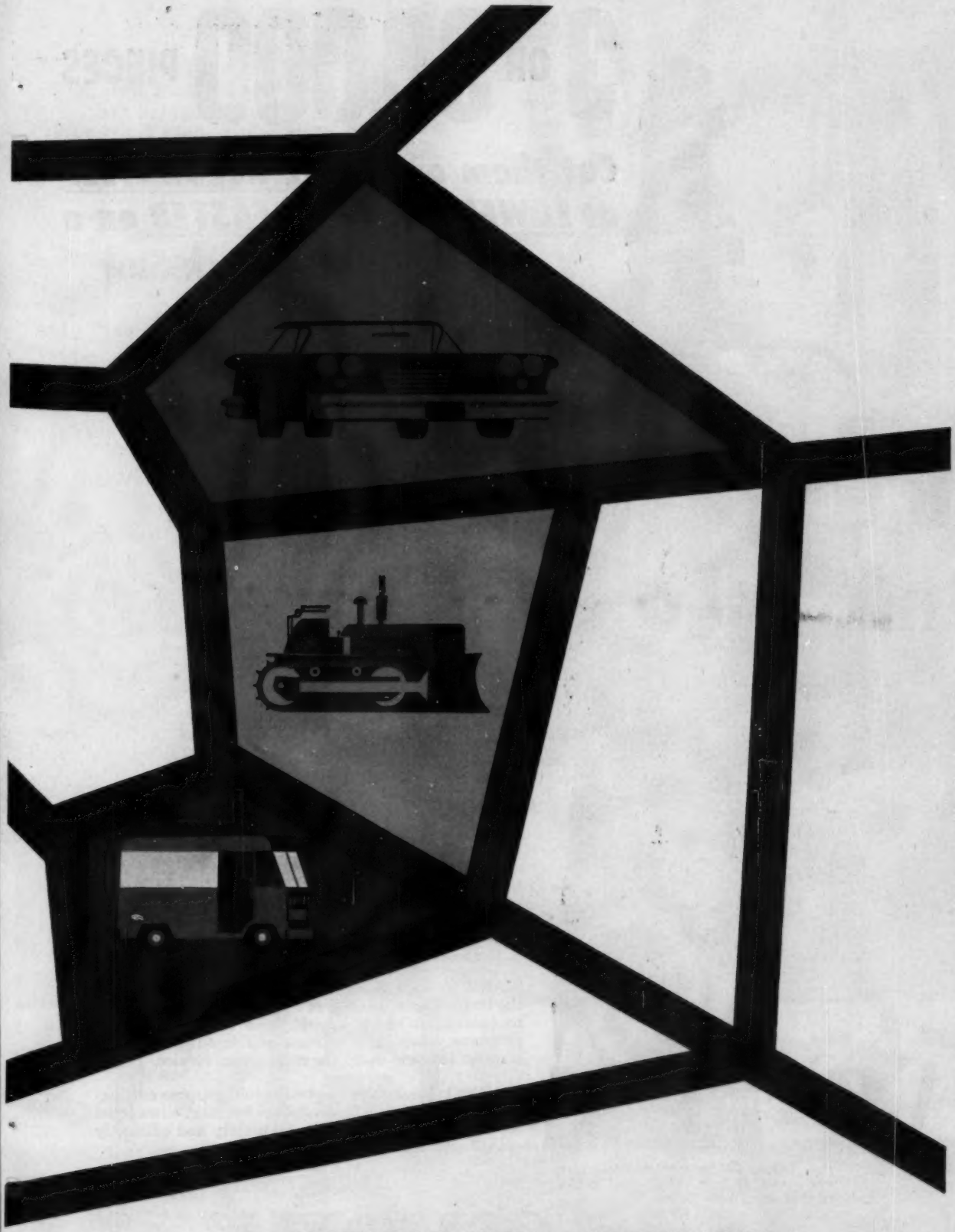
A PRODUCT OF

GREAT LAKES STEEL

Detroit 29, Michigan

Steel

Look for the STEELMARK on the products you buy; place it on the products you sell.



Great Lakes Steel is a Division of **NATIONAL STEEL CORPORATION**

3 OR 30,000 PIECES

Cut them off MORE ACCURATELY at LOWER COST and FASTER on a MARVEL Hack Saw

1. Accuracy? 2. Speed? 3. Low Cost?

Which is most important in your production or intermittent cutting-off operations? *You get all 3* when your work is handled on a MARVEL Series 6A or 9A Heavy Duty Ball Bearing Hack Saw. Whether you're cutting 3 or 30,000 identical pieces, you can be certain that each piece will be true . . . that it will be cut-off quickly, and at the lowest possible tool cost

MARVEL Hack Saws are fine machine tools, with all the built-in accuracy this description implies. Designed to operate at higher speeds, with the heaviest feed pressures, they have almost unlimited power and stamina to stand up to the most severe service.

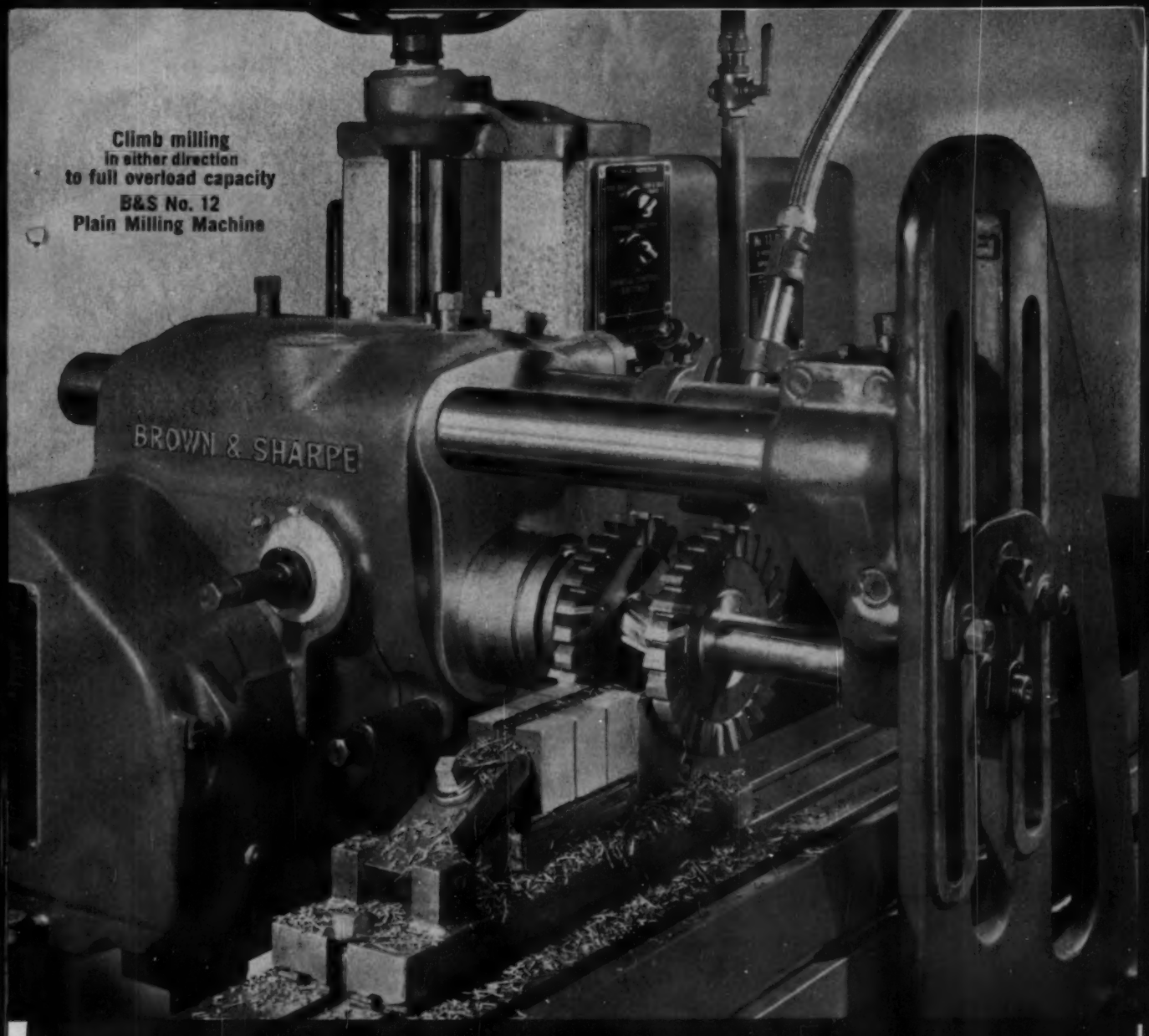
MARVEL Hack Saws are truly multi-purpose cutting-off machines. *No* run is too short or too long, *no* material too mild or too tough to be accurately and efficiently cut-off on a MARVEL Hack Saw.

Catalog C85 has complete details, facts and figures on both Marvel metal cutting Saws and Band Saws. Write for it today.

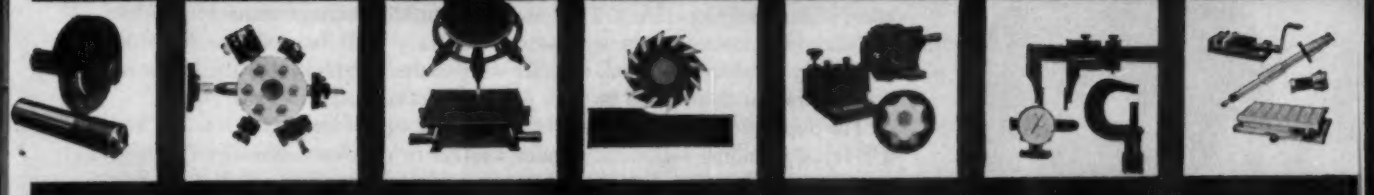
S-1306

ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILLINOIS

Metal Cutting MARVEL SAWS
Better Machines–Better Blades

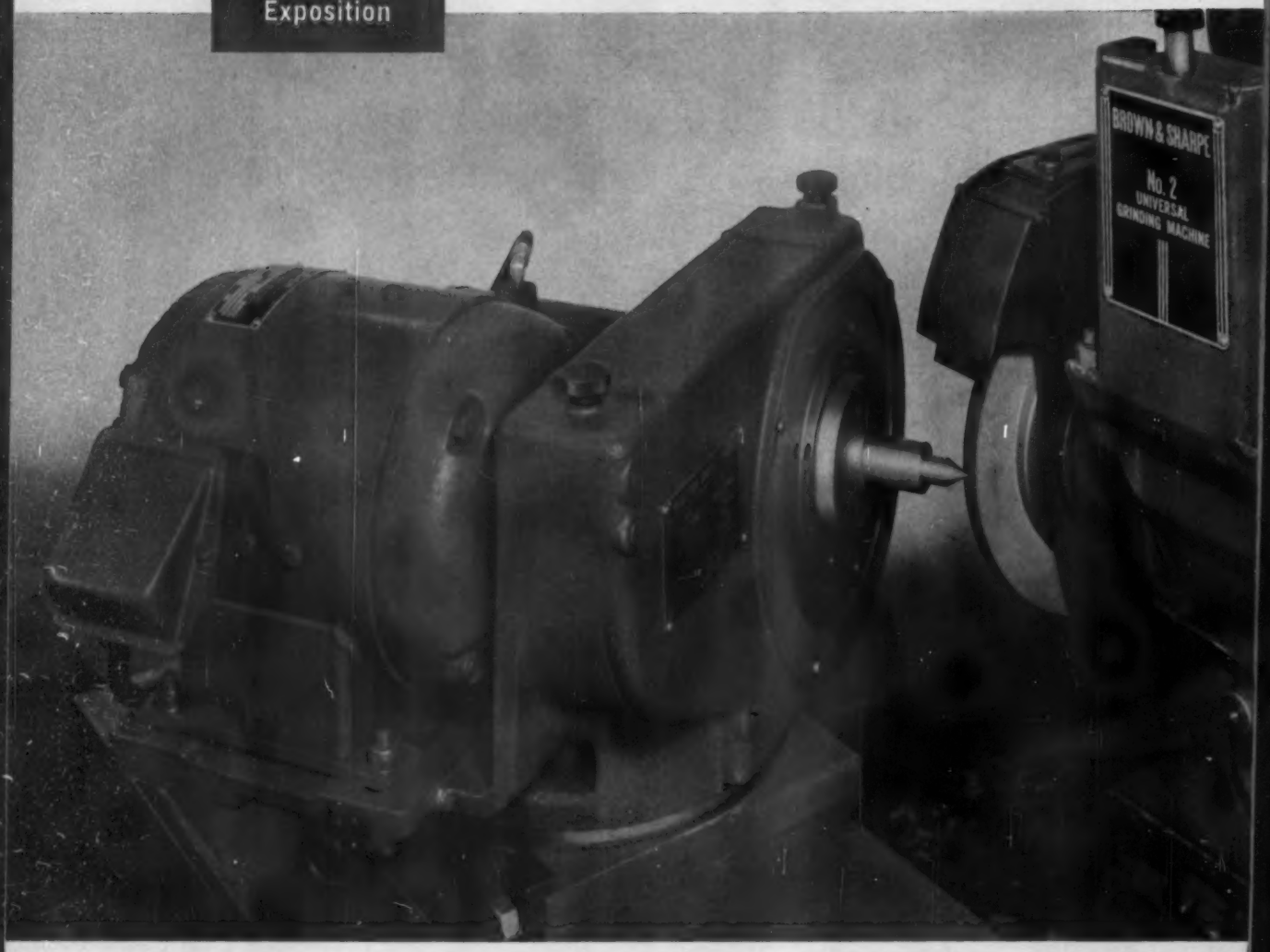


Climb milling
in either direction
to full overload capacity
B&S No. 12
Plain Milling Machine



STAR PERFORMERS at the Chicago Exposition

TO HELP YOU GRIND MORE FOR LESS



New Supercise Headstock for B & S Universal Grinders repeats size and roundness within ten millionths

Test chart indicates true roundness within 5 millionths of an inch.

With this new B&S designed hydrostatic headstock, grinding to split-tenth precision in size and roundness, with super-finish, can now be maintained in production runs, with average operators. The unique hydrostatic bearings automatically compensate for minute errors and assure accuracy well beyond the limitations previously considered normal. Contact wear of the spindle is virtually eliminated, and accuracy is maintained through years of constant use.

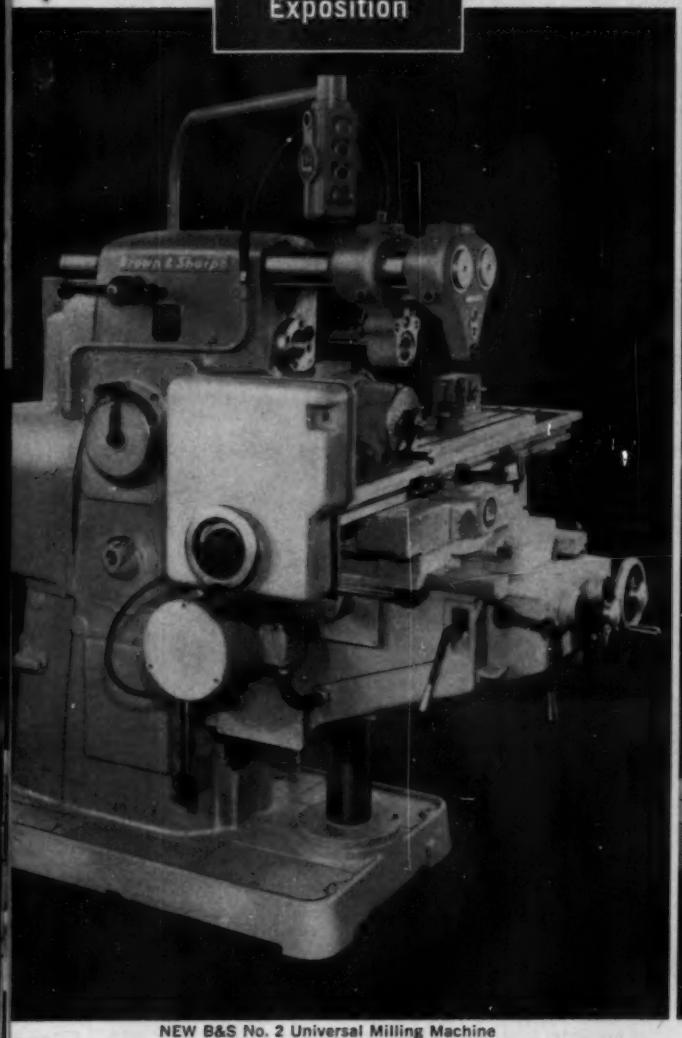
The Supercise headstock is available as special equipment on the No. 2, 3 and 4 Universal Grinding Machines. It adds another to the many exclusive features of B&S Universal design that frequently permit job-time savings of 75% or more.

You need all these extra B&S design advantages, when you select Universal Grinders for toolroom, prototype operations, or production grinding. Why settle for less? For details write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

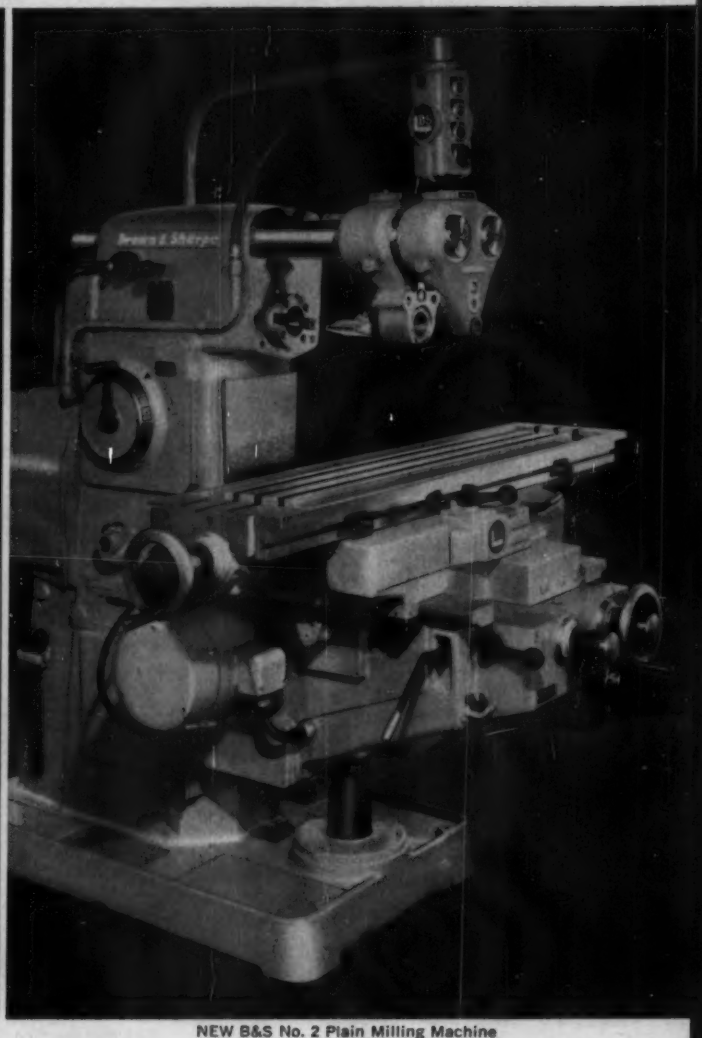
Brown & Sharpe PRECISION CENTER

STAR PERFORMERS at the Chicago Exposition

TO HELP YOU MILL MORE FOR LESS



NEW B&S No. 2 Universal Milling Machine



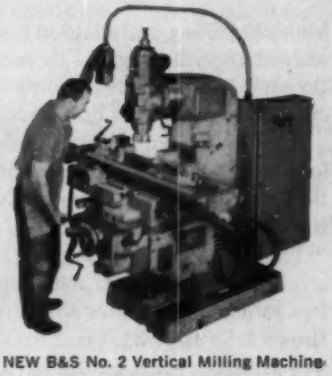
NEW B&S No. 2 Plain Milling Machine

New DYNAMASTER design "tailors" machine to fit the job - you buy only needed features - from 132 combinations

The Brown & Sharpe DYNAMASTER series is an entirely new concept in knee-type milling machine design. You can order any of 132 combinations of standard features, in 14 models of Plain, Universal, Vertical, and Rangemaster. You can also select the drive you need — 3, 5, 7.5 or dual 10/5 HP.

In every DYNAMASTER, you get heavier, balanced construction that puts the weight where it's needed — permits you to take full advantage of the fast-cutting potential of carbide and coarse-tooth cutters. Hydraulic gear shifting, and many other control improvements, set new standards of operating ease and simplicity.

Before you invest in milling equipment, get the complete story of the 27 design improvements, with 9 important advantages available only in a DYNAMASTER. For toolroom — maintenance — prototype work — short or long run production — the dollar-wise buy is a DYNAMASTER. For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.



NEW B&S No. 2 Vertical Milling Machine

Brown & Sharpe PRECISION CENTER

STAR PERFORMERS at the Chicago Exposition

TO HELP YOU DRILL AND TAP MORE FOR LESS

New B&S trunnion fixture with index head (right) permits fast, accurate positioning for holes in any plan

Drill, tap, bore, ream with .001″ hole locating precision – 2 to 5 times faster – with B&S Turret Drilling Machines

Multiple drilling operations at a single station, and fast, accurate hole location without expensive jigs — these are only two of the major advantages of the Brown & Sharpe Turret Drilling method. For large, as well as small parts, you can reduce production drilling costs up to 80% or more.

With a B&S Positioning Table and simple holding fixtures, accurate hole location (within .001″) takes only a few seconds in each sequence. On the B&S Model A Turret Drilling Machine, you can machine any hole pattern within a 24″ circle.

Find out how much you can save — in handling time, set-up time, capital investment, floor space, and maintenance. Send your parts and drawings for a free estimate of savings with turret drilling. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

B&S Positioning Tables are also sold separately for other machining needs. Write for details.

67 operations, 23 holes, in 4 planes . . . time: 10 min. 40 sec.

Brown & Sharpe PRECISION CENTER

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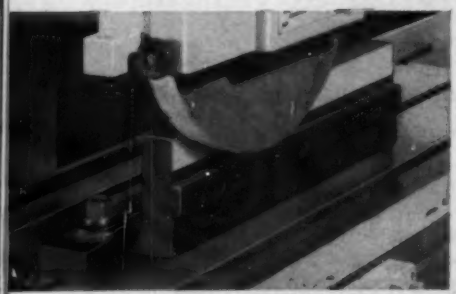
TO HELP YOU GRIND MORE FOR LESS

New Brown & Sharpe 1030 MICROMASTER Surface Grinding Machine

New profit-saving Surface Grinders for larger work - the B&S 824, 1024 and 1030 MICROMASTERS



Elimination of saddle (no table twist) assures accurate grinding of parallel, vertical surfaces.

Ever since the introduction of the 618 MICROMASTER, demand has steadily increased for larger capacity B&S Surface Grinders with the same profit-saving, super-precision performance. Now, they are ready — in 8″ x 24″, 10″ x 24″, and 10″ x 30″ sizes. You get full hydraulic control with table speeds from 10 to 125 fpm, and a generous 14½″ capacity under a 12″ wheel.

The broad based, rugged construction assures lasting precision to ten-thousandths, and flawless microinch finishes. You can choose the 5HP direct drive, or the 3HP Oriflex drive, according to your needs. All basic controls are at the operator's fingertips.

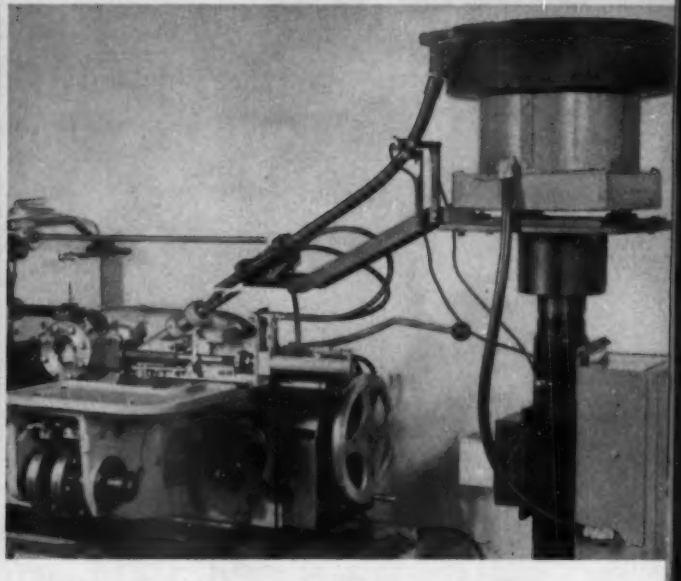
You can order your MICROMASTER with any of a wide selection of optional equipment, or factory-modified to give you exactly the machine you need. Why settle for less — or more?

For full information, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, R. I.

Brown & Sharpe PRECISION CENTER

STAR PERFORMERS at the Chicago Exposition

TO HELP YOU MAKE MORE FOR LESS WITH SCREW MACHINES



B & S Automatics provide new cost-saving advantages for any type of screw machine work

The new design features, attachments, and feeding devices demonstrated at the Chicago Exposition offer every screw machine user spectacular opportunities for big savings. You can include more operations in bar work and boost production speed. You can cut loading time more than 50% in second operation work.

With new design B&S Automatics and accessories, you can make daily dollar savings, and write off your investment in record time. Get details. Write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Ask for information on NEW faster feeding at 10,000 R.P.M. with Automatic Bar Feed Magazine • **NEW drilling and broaching attachment** that permits punch broaching with 18,000 lbs. air pressure • **NEW Automatic Hopper Feeder** for second operation work that cuts loading time more than 50% • **NEW electronic gaging** that checks every piece • **NEW fourth slide,** with 2 tool holders, that permits added operations in cycle.

Brown & Sharpe PRECISION CENTER

Another Tinnerman Original...

Nut-in-a-cage eliminates welding or staking...

SPEED GRIPS® hold themselves on panels!

Wherever you require a heavy-duty, multi-thread, self-retaining fastener, a Tinnerman SPEED GRIP Nut Retainer answers the need, holds down assembly costs.

SPEED GRIPS snap into place... some into panel holes... others over panel edges. No special tools or skills required. Spring-steel fingers grip the panel, yet let the nut float to compensate for normal panel-hole misalignment. Welding, staking and clinching are eliminated. SPEED GRIPS can even be applied after panels have been finished, avoiding paint-clogged threads.

SPEED GRIPS are available in a wide range of sizes and types, including front-mounting nut and bolt retainers for hard-to-reach or blind locations.

See your Sweet's Product Design File, section 8-T for data on these and other SPEED NUT Brand Fasteners. Your Tinnerman representative has complete information and samples. If he isn't listed under "Fasteners" in your Yellow Pages, write to:

TINNERMAN PRODUCTS, INC.
Dept. 12 • P.O. Box 6688 • Cleveland 1, Ohio

TINNERMAN
Speed Nuts®

FASTEST THING IN FASTENINGS®

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S. A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano-Bundy GmbH, Heidelberg.

NEW FROM FAIR STREET • HOME OF THE JIGMIL

new series

"Designated the model 'H,' our new Jigmil series provides greater range, is more rugged, easier to operate and more accurate."

"Available in spindle sizes ranging from 3" to 5", the new 3H, 4H and 5H machines greatly increase JIGMIL range for precision boring, milling, drilling and other operations. The new series introduces simplified controls, thermal control of main spindle bearings for increased accuracy . . . wider bed and table for added stability and working range . . . stainless steel way covers for positive protection . . . features that reach a new standard in JIGMIL accuracy, ruggedness and simplicity of operation. And like all JIGMILS, the 'H' series is available with the DeVlieg Diatrol direct dial dimensioning system or Tapac* —DeVlieg's own system of automatic tape control."

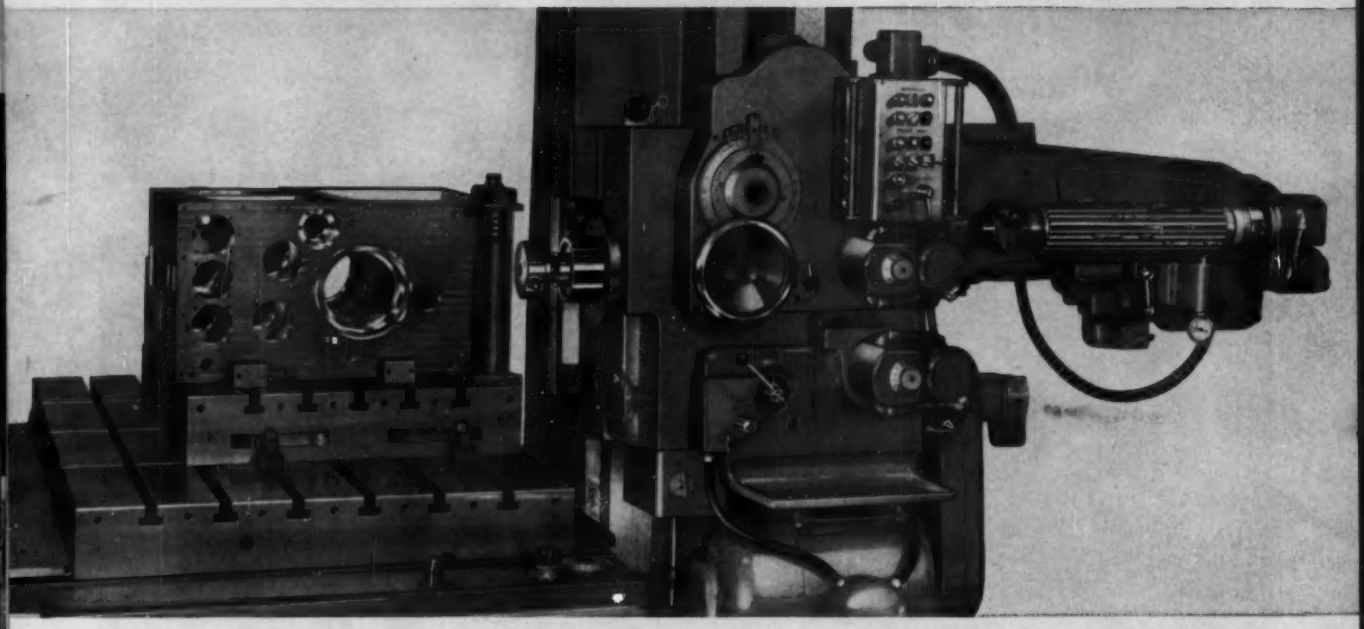
R. A. JERUE
Vice President in Charge of Engineering

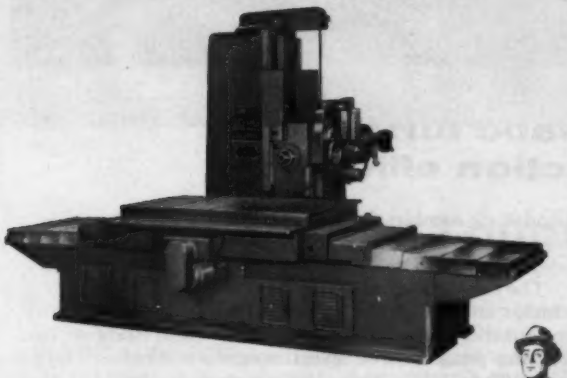
**Tape Automatic Positioning And Control*

DEVLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN

"H" Jigmils®

with Duplitrol • Diatrol • Tapac





Illustrated above is a Precision Spindle Head Casting being machined on a Model 3H-72 Spiramatic JIGMIL. Series 3H machines have 3" diameter spindle bar, 36" vertical travel and 48", 72" or 96" horizontal travel, designed for machining all types of production work and one-piece jobs in the medium size range.

Rewarding revelations in automatic precision await your next visit to Fair Street

DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it

Completely automatic turret lathe gives peak production efficiency

J & L's new, completely automatic turret lathe sets a new high standard of efficiency for both bar and chuck work. Now, for the first time, you have the versatility of turret lathe tooling combined with completely automatic operation. All machine functions and sequences are pre-selected and programmed by the operator or set-up man, from a staging panel during initial set-up.

The automatic machine characteristics of this new lathe include fast motion, variable speed selection, spindle speed selection, turret indexing, coolant on and off, bar feed, and cycle stop.

A noteworthy feature is the automatic operation of a 12-speed hydraulic clutch headstock combined with a 24″ saddle motion which is actuated by a closed-loop, two-stage hydraulic servo system.

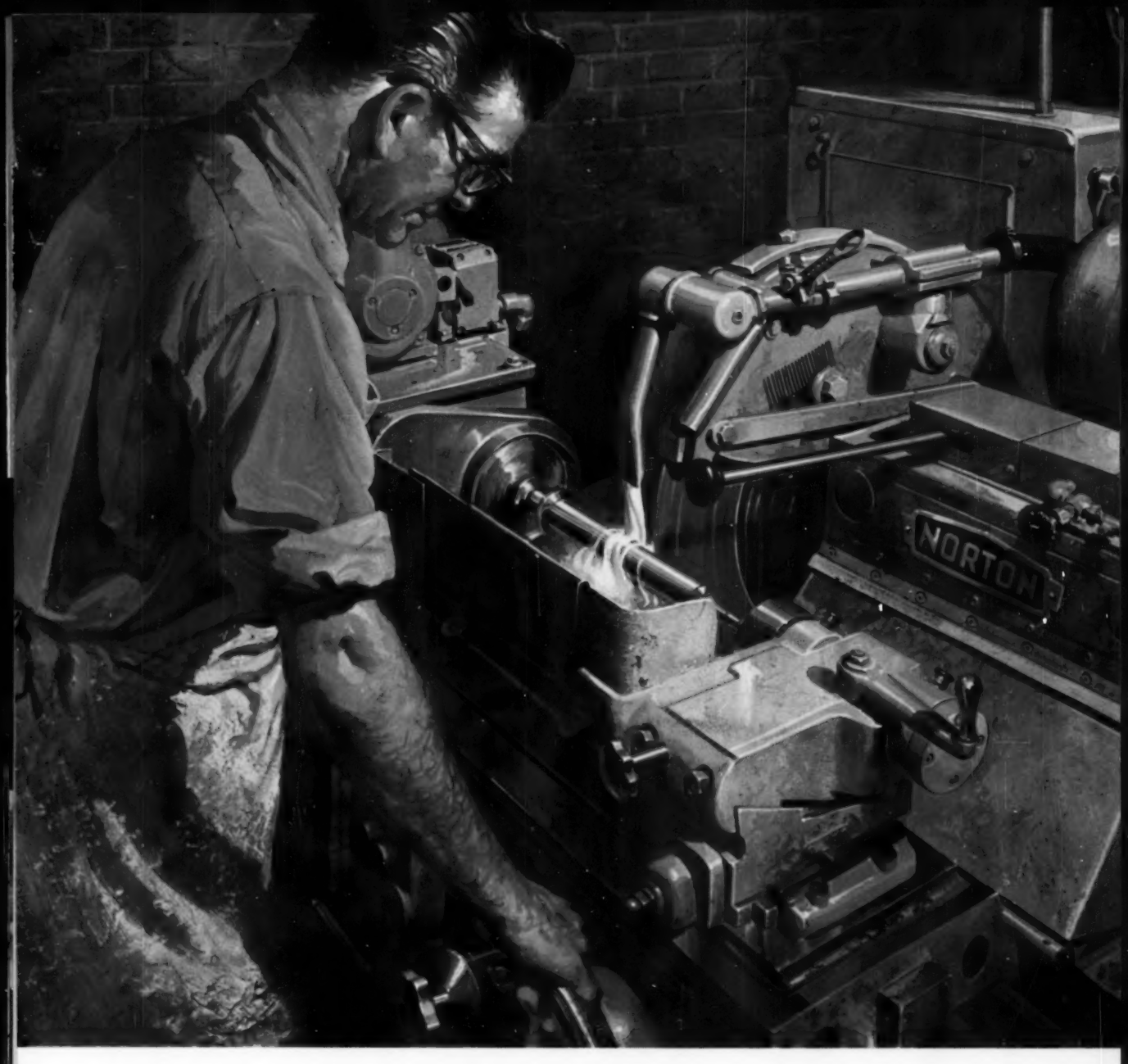
The cross slide has a 14½″ stroke and drive similar to that of the saddle, and has several automatic cycles, as programmed from the staging panel. Three speed ranges are available: 20 to 1000; 30 to 1500; and 40 to 2000 RPM. Power is from a single speed motor (up to 40 HP). Feed range is from .750″ per minute to 30″ per minute for the saddle, and from .375″ per minute to 15″ per minute for the cross slide.

Send now for our folder on this remarkable new machine. Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

CIRCLE 199 READER SERVICE CARD

CIRCLE 200 READER SERVICE CARD ►



Adding the "Touch of Gold" all around

He's finishing a shaft with the two best tools — a Norton grinding wheel on a Norton cylindrical grinder.

In O.D. grinding as in every other type, choosing your wheels calls for just as much care as choosing your machines. New manufacturing techniques, combined with improved bonds, provide excellent structural uniformity and the best-balanced wheels in the industry. So, remember that Norton O.D. wheels are engineered to add the product-improving, cost-cutting "Touch of Gold" all the way 'round any cylindrical workpiece.

Get these "Touch of Gold" benefits working in your production. Your Norton man, a trained Abrasive Engineer or your Norton Distributor will be glad to tell you how. NORTON COMPANY, General Offices, Worcester 6, Massachusetts.

NORTON
ABRASIVES

75 years of . . . **Making better products . . . to make your products better**

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

NEW 'BUFFALO' NO. 20

DRILLING MACHINE

Entirely new from the ground up . . . designed and built to give you the same consistent accuracy and extended service for which the complete 'Buffalo' drilling machine line is so well known.

Check These Features of the No. 20:

- **Designed for operator's convenience.**
- **Front-Mounted "Start-Stop" Push Button Switch.**
- **5-Step Pulley Drive (Or Optional Variable Speed Drive).**
- **Power Feed or Sensitive Hand Feed.**
- **Capacity: 1" in Mild Steel.**
- **Hinged Belt Guard Speeds Belt Changing.**
- **Positive Frame-to-Column Locking Device.**
- **Hand-Adjustable Spindle Return Spring.**

Available in floor, bench and pedestal models . . . one to six spindles.

For full details on the all-new No. 20 Drill (or any other model from the complete 'Buffalo' line), contact your 'Buffalo' Machine tool dealer or write us direct.

ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

MACHINE TOOL DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

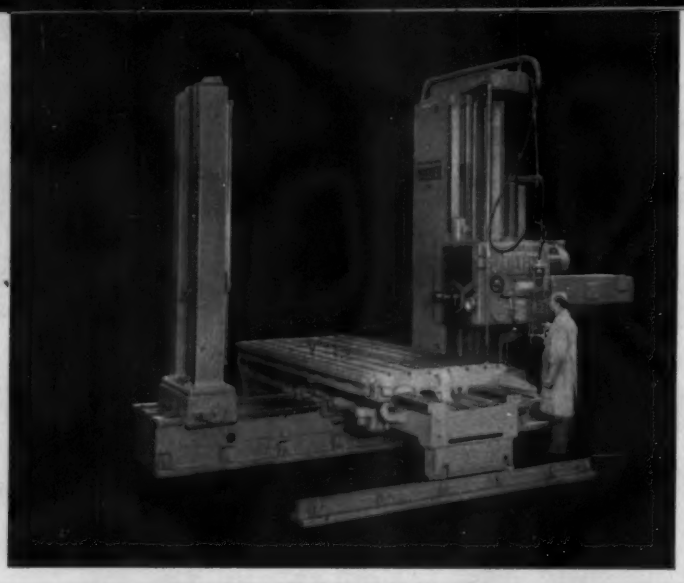
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

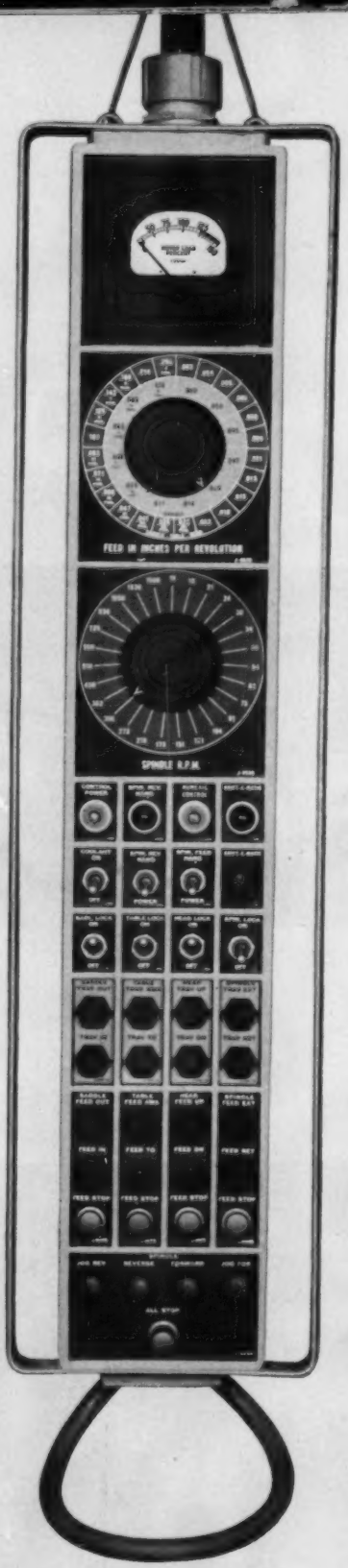
'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cape for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.





15 ways to profit– at your fingertips

Put this pendant station in the hands of your operator, and he will obsolesce any table type boring mill your competitors may have. At his command will be a system of features calculated to increase your boring, milling, and drilling profits:

1. Operator can see the cutter while controlling machine.
2. Pre-selective speeds & feeds; power automatic shift.
3. Built-in reversible motor (no long shafts or bevel gears to spindle drive).
4. Spindle hardened to full 5/32″ depth; hardened taper.
5. Spindle speeds up to 1500 rpm.
6. Automatic depth control for full travel of spindle.
7. Screw feed to spindle.
8. Milling feed calculations by chip load per tooth.
9. Up to 25 hp motors available.
10. Anti-friction bearings throughout.
11. Hardened bed & saddle ways; non-metallic head ways.
12. Pressure or splash lubrication to all running parts.
13. Long narrow guides, screw feeds within guides.
14. Wide selection of column, table and bed sizes.
15. Wide selection of accessories, such as automatic positioning, tracer controls, tape controls, extended saddles with supports, power tool lock.

Our quotation will convince you that this is an exceptionally good machine tool buy.

The Cincinnati Gilbert Machine Tool Co., 3340 Beekman St., Cincinnati 23, Ohio.

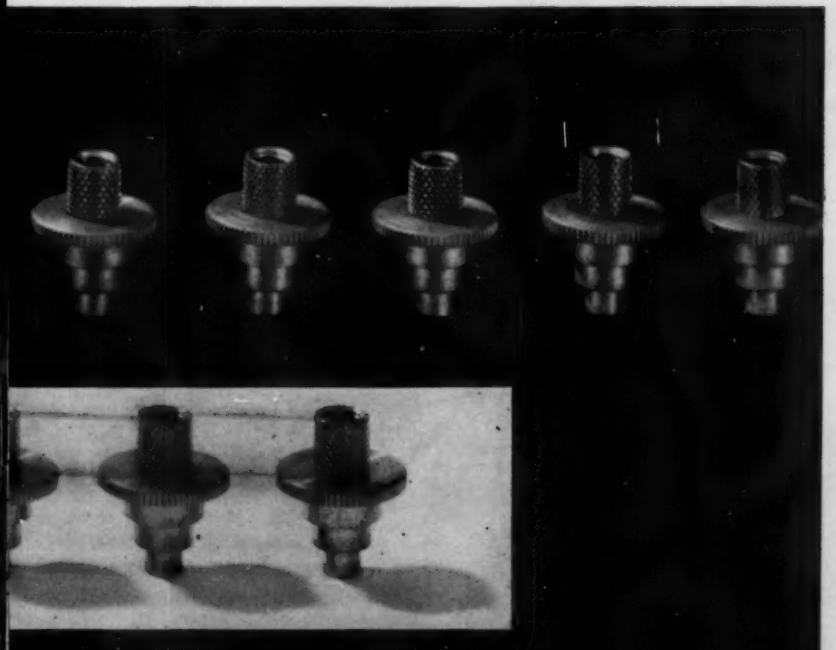
Write for free catalog

GILBERT

CIRCLE 202 READER SERVICE CARD

More Parts Per Minute!

New Micro-Chip 2011-T3 Screw Machine Stock Machines at Highest Speeds With Fewest Stops*



If more parts per *minute* is what you're after, you'll get it from new Kaiser Aluminum Micro-Chip 2011-T3 rod and bar. It delivers these advantages immediately:

1. LESS RESETTING OF TOOLS—Kaiser Aluminum's new Micro-Chip process makes Micro-Chip 2011-T3 uniform in machining characteristics from lot to lot, and throughout each bar. Consistent machinability means less tool resetting... less down time... lower unit cost.
2. FASTER MACHINING—Micro-Chip turns out finer, smaller chips... increases machining surface speeds as much as 40% over other standard screw machine alloys ... more parts with minimum tool wear.
3. BRIGHTER, CLEANER SURFACE—Micro-Chip stock is cleaner and brighter. Even portions not machined have a quality finish without special handling.
4. BOTH ENDS CHAMFERED†—Chamfering at both ends of Micro-Chip rod and bar eliminates awkward work of reversing metal for entry into the machine—reduces feed finger wear.

†*From ⅛" to 2" inclusive*

CALL YOUR KAISER ALUMINUM DISTRIBUTOR—Kaiser Aluminum Micro-Chip is now available through Kaiser Aluminum Distributors or your Kaiser Representative. Micro-Chip comes in 12-foot lengths, up to 3-inch diameter and 2-inch hex in standard 200-pound packages—*at no increase in price* over regular 2011-T3. Ask for "Micro-Chip" and look for the label.

*T. M. of Kaiser Aluminum & Chemical Corp.

Kaiser Aluminum & Chemical Sales, Inc.
Kaiser Center, 300 Lakeside Drive,
Oakland 12, Calif.

KAISER ALUMINUM

* TRADEMARK OF KAISER ALUMINUM & CHEMICAL CORPORATION

BRIGHTER CLEANER

MICRO-CHIP

2011-T3

Unique new use of special

In manufacturing, fragility and heavy maintenance costs are intolerable. That's why General Electric's F. W. Rueblinger investigated the replacement of milling cutters with diamond abrasive wheels in his arc-quencher finishing operation. As Manager of Manufacturing of G-E's Medium Voltage Switchgear Department, Philadelphia, he was dissatisfied with having to maintain a large inventory of cutters and to keep men working around the clock sharpening and replacing them.

Arc-quenchers are made of a hard and extremely abrasive asbestos compound. This presented such a problem that all but one of the abrasive people consulted threw in the sponge. The one who didn't was Bay State distributor Vince Flynn. He arranged for key General Electric production men to meet with Bay State's Research Staff in Westboro and the problem was examined from every possible angle.

Finally, after extensive development work, Bay State engineered a special 12" diamond wheel that cut fast and maintained the extremely fine tolerances necessary in the finishing of these important parts of Metal-clad Switchgear.

With as many as 136 wheels on a single arbor simultaneously making ¼" deep cuts, the problem of driving power alone could have been disastrously troublesome. However, the wheels Bay State developed cut so easily that it was possible to increase the feed rate nearly 400% . . . and overall productivity went up a good 50%!

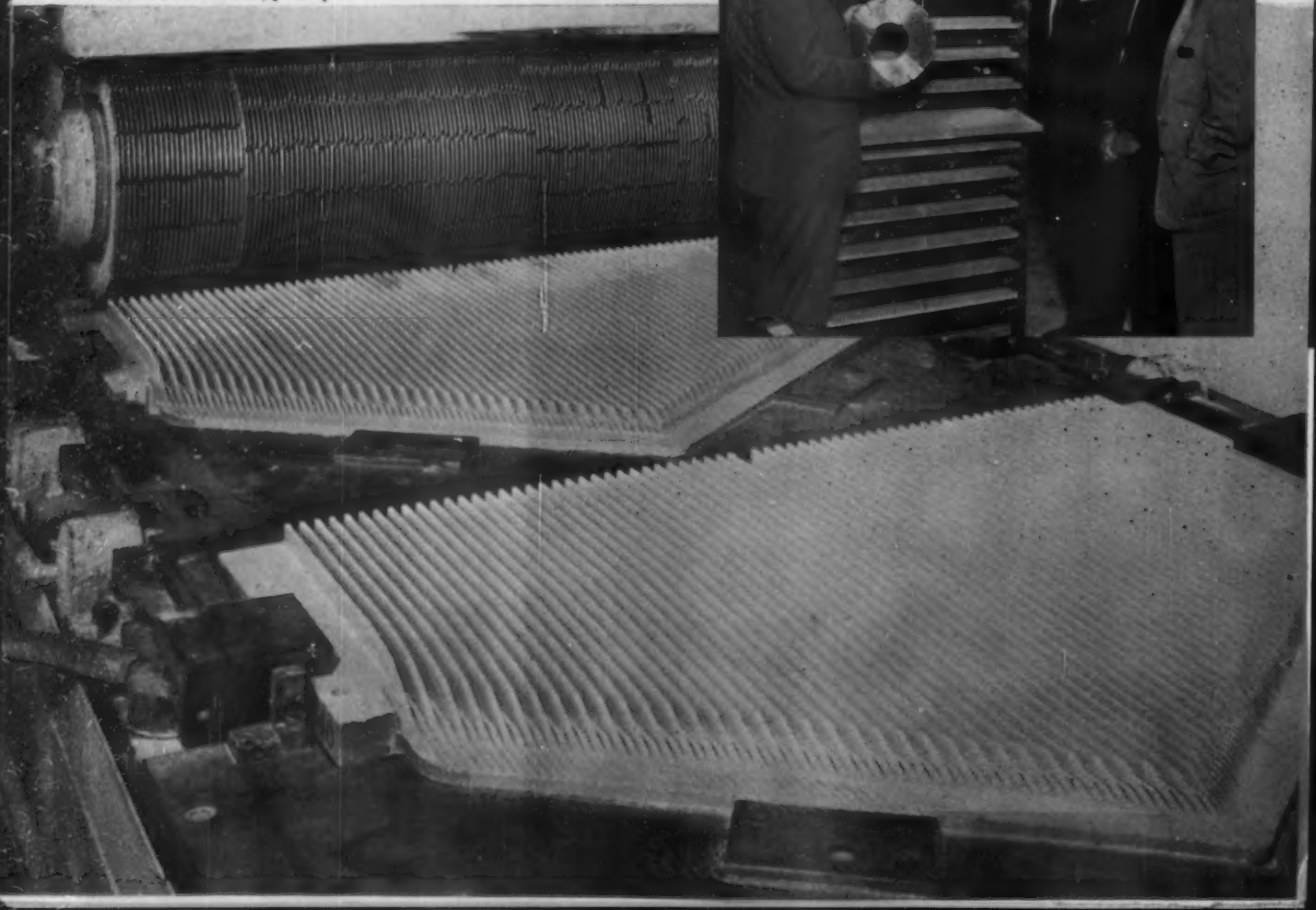
On top of these already proven advantages, wheel life is estimated at three full years so the constant down-time problems that used to arise from the need for cutter maintenance is entirely a thing of the past.

This outstanding success is not the end of the story. Now that General Electric's man-made diamonds are available for metal-bonded wheel applications, Bay State is engaged in intensive research into the even greater application potentials of this material.

Whether you have an unusually complex problem, or are simply trying to pare down costs, you'll find your Bay State distributor or direct representative is both hard-working and thoroughly experienced. *Better grinding at lower cost . . . that is his business.*

Right: Discussing the increased productivity that resulted from grinding, instead of cutting, hard asbestos-composition arc quenchers, are, left to right, Vincent J. Flynn, Bay State Distributor, F. W. Rueblinger, Manager-Manufacturing, John Stabb, Supervisor-Advanced Manufacturing-Engineering, and William A. Siter, Manager-Manufacturing-Engineering.

Below: Two arc-quenchers are shown immediately after passing under a tremendous array of 136 Bay State diamond wheels which have made simultaneous cuts ¼" deep.



diamond wheels ups productivity 50%

Vincent J. Flynn was a Tool & Die Maker at the Frankford Arsenal when World War II came along and he joined the U.S.A.F. With this solid background in practical shopwork, he went into industrial distribution after the war, opening up his own business 5 years ago. Now a highly successful Bay State Distributor, he has this to say about Bay State: "They not only give me and my customers first-class service on routine problems . . . they also roll up their sleeves and dig in every time I come up with a puzzler . . . like this one, for example."

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Los Angeles, Pittsburgh. *Distributors:* All principal cities.

CIRCLE 206 READER SERVICE CARD

WESTERN UNION TELEGRAM

W. P. MARSHALL, PRESIDENT

1201

SYMBOLS
DL = Day Letter
NL = Night Letter
LT = International Letter Telegram

CLASS OF SERVICE
This is a fast message unless its deferred character is indicated by the proper symbol.

The filing time shown in the date line on domestic telegrams is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination

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AMERICAN STEEL FOUNDRIES, ELMES-KING DIVN
CIN

OUR ELMES STRAIGHTENING PRESS IS A BIG FACTOR IN COST CONTROL BECAUSE OF ITS SPEED MANEUVERABILITY, AND NEGLIGIBLE MAINTENANCE REQUIREMENTS

BUCYRUS ERIE CO R C BYERS

At the Erie Plant of Bucyrus-Erie Company, this Elmes 400-ton Traveling-Head Straightening Press handles a wide variety of sizes and shapes of castings used in building heavy duty construction machinery.

ELMES Hydraulic Presses and Equipment

KING Vertical Boring and Turning Machines

American Steel Foundries/ELMES-KING Division, 1150 Tennessee Avenue, Cincinnati 29, Ohio

Difficult hole location problems solved for short runs

At the Westinghouse Ordnance Plant, Lansdowne, Maryland, a Sheffield Coordinate Measuring Machine determines the true location of 18 holes in a magnesium integrator or gear box. Fifteen holes are checked to ±.00017; two holes to ±.00023; and 1 to ±.000075 (75 millionths).

Inspection with a height gage and setting master previously took two days and did not determine out-of-round condition. The Sheffield gage reduced the time to six hours including set-up and cooling out—and checked for out of roundness as well. Overall accuracy of the gage has proved to be within .000075 on both horizontal axes and in the 10" vertical range. Repeatability is within .000010.

100% of the parts which passed inspection on this Coordinate Measuring Machine proved to be perfect in assembly, test, and field use. Short production runs of parts that vary widely in size and hole location, are easily handled.

Write for catalog number P-193 or check with your nearby Sheffield representative on your gaging requirements.

NEWS: **Before 11:00 a.m. on the first day of the NMTB Exposition in Chicago, September 6, 1960, a Fort Wayne, Indiana manufacturer bought a similar machine being demonstrated in the Sheffield booth. Additional orders continue to come in.**

The **SHEFFIELD** *Corporation* *Dayton 1, Ohio*

A subsidiary of The Bendix Corporation

Gages, Measuring Instruments, Automatic Gaging & Assembly Systems • Machine Tools • Contract Mfg.

another tough problem solved with...

REPUBLIC ELECTRUNITE MECHANICAL TUBING

Republic's tube making know-how and fabricating facilities combined to solve a tough problem for the Kuhlman Electric Company, Birmingham, Michigan.

Kuhlman engineers wanted a material to meet the designs of the new Kuhlman "Quick-Grip" H.V. transformer bushing that would reduce radio noise without oil. They preferred the part supplied as a finished product.

A bushing sleeve made of Republic ELECTRUNITE Carbon Steel Mechanical Tubing, 2⅜" O.D., 10-gage, was the answer. The sleeve is approximately 3" long and has a chamfer on one end. Holes are punched on circumference, and the other end of the tubing is expanded. Coarse threads are cut in the expanded metal on an automatic screw machine.

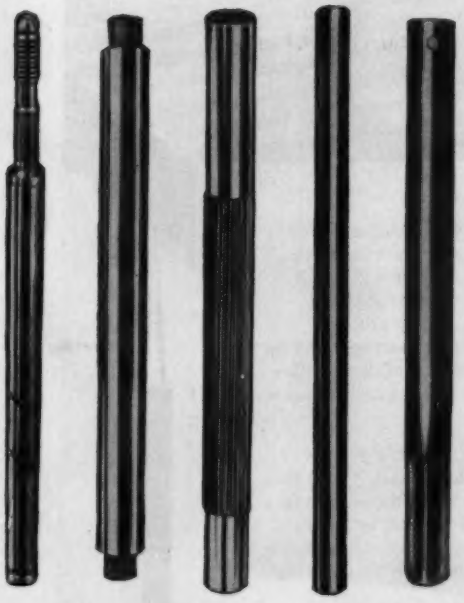
This is a typical example of the flexibilities in fabrication of ELECTRUNITE. And Republic's Steel and Tubes Division has the facilities, equipment, and "know-how" to fabricate all grades and types of ELECTRUNITE carbon and stainless steel tubing into whatever shapes your product requires.

ELECTRUNITE is available in a wide range of sizes, gages, and wall thicknesses in both carbon and stainless steel. Call your Republic representative. Or, write direct. Use coupon below.

The Kuhlman "Quick Grip" H.V. sleeve, made of Republic ELECTRUNITE Mechanical Tubing, is a feature of the K-E Kuhlman Transformer, engineered and manufactured by the Kuhlman Electric Company, Birmingham, Michigan.

REPUBLIC NYLOK NUTS proved to be the solution for fast production and plus-safety features in the manufacture of an automobile steering mechanism, shown above. NYLOK nuts are ideal for automatic feeding, and give permanent, vibration-proof lock. Easy adjustment and re-use assured by permanent resiliency of the nylon pellet. Can be easily backed-off for parts inspection and adjustment. Write for data.

REPUBLIC ELECTRUNITE STAINLESS STEEL TUBING, Type 304, 4½″ O.D., was used to fabricate corona rings for a powerful East Coast Navy Radio Station. Despite the rather severe bend of the 15- and 20-foot rings, the fabricator reported no trouble whatsoever. The rings were made in three sections. ELECTRUNITE was bent to the correct radius. Three lugs were welded to each section. The ends were flared for the insertion of a plug used at the erection site to assemble the unit and suspend it from towers. ELECTRUNITE Stainless Steel Tubing and Pipe are available in most A.I.S.I. analyses from ⅜″ O.D. to 5″ O.D. Send for data.



REPUBLIC CENTURY SERIES of high strength, stress-relieved, cold finished steel bars meet the needs of steel parts producers requiring high strength with varying degrees of machinability. Available in five grades—C-1144, C-1141, C-1151, C-1050, C-1045—with each grade having a minimum yield strength of 100,000 psi. The CENTURY SERIES assures dimensional stability with excellent machinability, provides high mechanical properties in a range of chemistries. Send for booklet.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

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Please send more information on the following products:

- ☐ Republic ELECTRUNITE® Mechanical Tubing
- ☐ Republic ELECTRUNITE Stainless Steel Mechanical Tubing
- ☐ Republic CENTURY SERIES Cold Finished Steel Bars
- ☐ NYLOK® Bolt and Nut Fasteners

Name_____ Title_____

Firm_____

Address_____

City_____ Zone____ State_____

CIRCLE 210 READER SERVICE CARD

Heller nucut *American Pattern* Files

SMOOTHER FINISHES COME FASTER when Heller NUCUT Files sink their double-acting, non-tracking teeth into the work. While coarse teeth are chewing off metal with less pressure and fewer strokes, fine teeth add the finishing touches. Wavy grooves formed by irregular tooth size and spacing break up chips, minimize loading, reduce chatter. Fewer files are used. Files last longer. Filing time and costs are lower than ever before.

SEEING IS BELIEVING! Test Heller NUCUT Files with "Wavy-Teeth" against any other brand. You'll find, size for size and cut for cut, no other file cuts so fast and lasts so long as a Heller. Your nearby Heller Distributor stocks Heller Files in every type, shape, size and cut you'll ever need for faster better filing at lowest cost.

Heller for Heller

17.9.12

HELLER TOOL CO.

HELLER TOOL CO. SINCE 1836

America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO
Subsidiary of Simonds Saw and Steel Co.

Branch Offices and Warehouses: Newark, N. J. • Detroit • Chicago • Shreveport • Los Angeles • Portland, Oregon

HARDINGE
ELMIRA, N.Y.

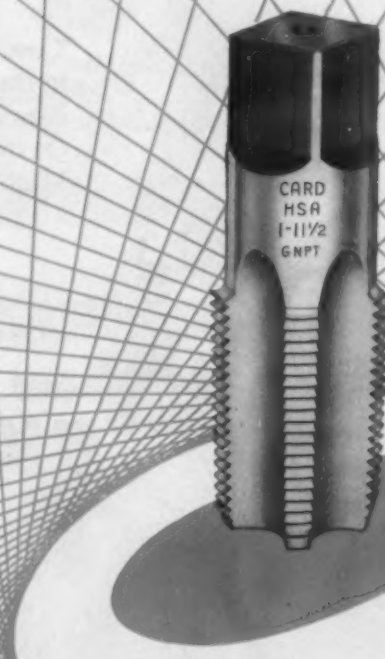
Turn, Face, Bore and Thread Parts In *One Chucking* and *One Handling* To Extreme Accuracy — At Low Cost On the New Model Hardinge Chucking Machine.

Write for FREE bulletin

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Offices in Principal Cities: Export Office: 269 Lafayette St., New York, N. Y.



CALCULATED TO CUT COSTS

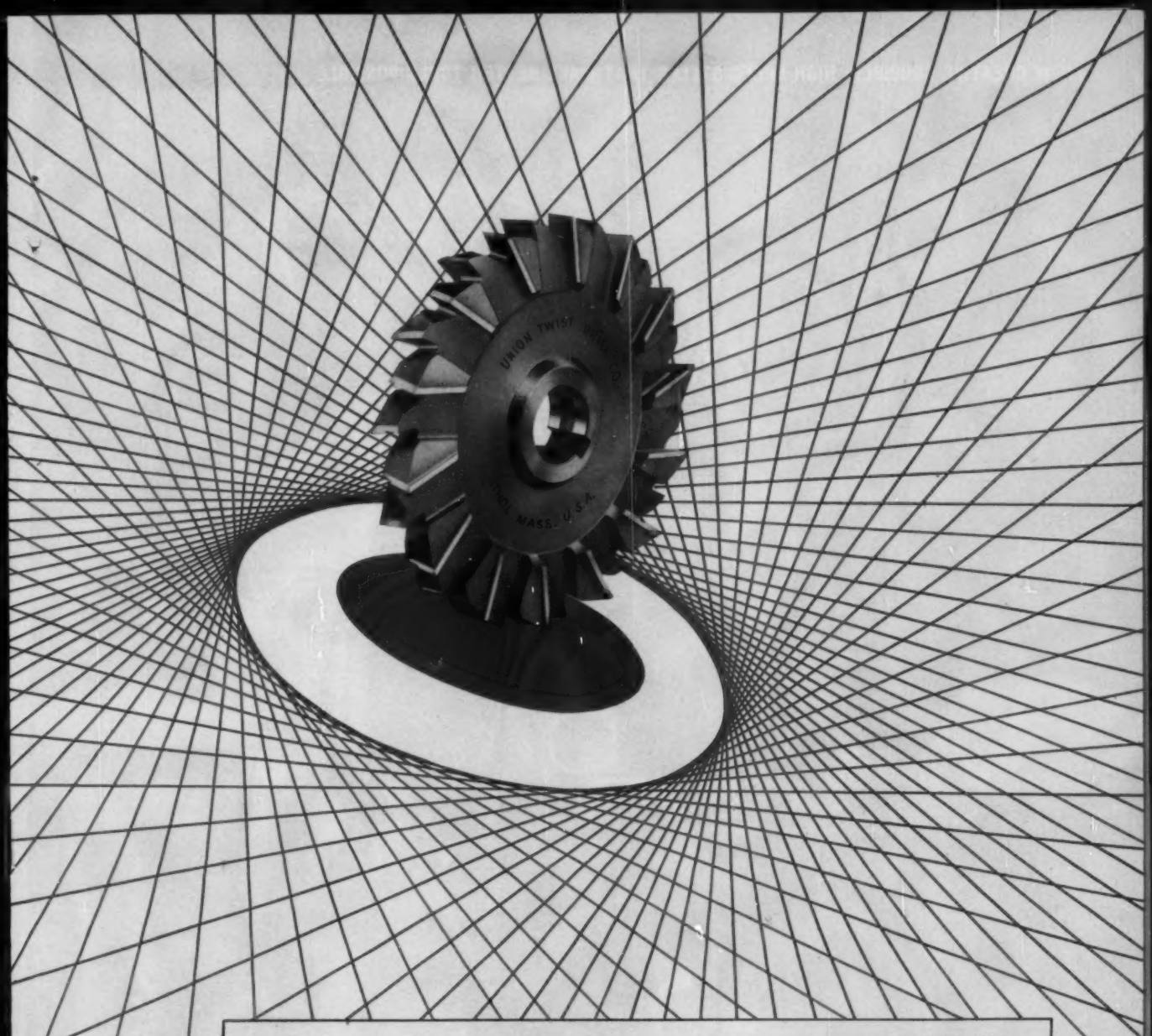
A truly geometric pattern is followed in precisely duplicating each CARD tap, according to type and size. For high volume, high quality production, specify CARD taps. Your CARD Distributor can make fast deliveries of the taps, dies, gages and screw plates you need. For helpful advice on their selection and use, call in your CARD technical man. S. W. CARD DIVISION, Mansfield, Mass.
Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York and San Francisco.

CARD

DIVISION OF UNION TWIST DRILL COMPANY

Serving you through the best distributors from coast to coast

CIRCLE 213 READER SERVICE CARD



GEOMETRIC PROGRESSION STABILIZES PRECISE DUPLICATION

CALCULATED TO CUT COSTS

Production of UNION cutting tools is like geometric progression. Each UNION milling cutter of the same size and type is precisely duplicated. This exact duplication brings valuable production benefits to every user. For more dependable performance, longer service life, specify UNION milling cutters, drills, reamers, end mills, gear cutters, hobs, carbide tools, and inserted blade cutters. Available nationally through UNION Distributors and stocked in UNION warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City, and San Francisco.

UTD

UNION

UNION TWIST DRILL COMPANY, Athol, Massachusetts

S. W. Card Division, Mansfield, Mass. Butterfield Division, Derby Line, Vt.

CIRCLE 214 READER SERVICE CARD

FROM CREATIVE CRUCIBLE: HIGH SPEED STEELS THAT MAKE BETTER TOOLS POSSIBLE

TO MAKE SURE A TWIST DRILL'S CUTTING EDGES ARE SHARP AND CLEAN, an inspector measures its chisel angle, point angle and lip relief under the powerful lens of a precision instrument. **Continually-improved Rex High Speed Steels help produce the fine edges so essential in twist drills.**

CIRCLE 215 READER SERVICE CARD

MORE HOLES PER DRILL *Today's twist drills meet new standards for hardness, toughness and strength– because of continually improved Rex® High Speed Steels.*

Drills, the most heavily loaded cutting tools in metalworking, are now meeting even more exacting requirements. A matter of economics accounts for the new standards: because, *the profitability of the automated equipment in which the drills are being used depends solely on their performance.*

Twist drills that meet customers' strictest specifications–for hardness and toughness, for strength and precision–are being produced right now. They're available because of the drillmakers' continuing research and skill – combined with Crucible progress in making better high speed steels.

TWIST DRILLS made of Rex High Speed Steels consistently meet the drillmakers' exacting tests for hardness.

To produce the fine steels needed for twist drills, Crucible tool steel specialists now use the most advanced electronic instrumentation available. For example: they can record the temperature of the molten metal in the melting furnaces within 5 seconds. So, each heat is produced under identical temperature conditions.

Crucible specialists employ new techniques that also greatly improve deoxidation of the liquid steel. They use new ingot mold designs to minimize segregation. And they ultrasonically inspect every billet of Rex High Speed Steel before rolling or forging to ensure freedom from internal voids, flake, inclusions, etc.

For complete information on how Rex High Speed Steels can help make precision tools better, call or write the Crucible branch office or service center near you.

BETTER TOOLS, THROUGH BETTER STEELS. Constant improvement of Rex High Speed Steels ensures the increasingly better performance of hobs, taps, broaches and cutters — as well as twist drills.

CRUCIBLE STEEL COMPANY OF AMERICA

Branch Offices and Warehouses: Atlanta • Baltimore • Boston • Buffalo • Caldwell, New Jersey • Charlotte Chicago • Cincinnati • Cleveland • Columbus • Dallas • Dayton • Denver • Detroit • Erie, Pennsylvania • Grand Rapids • Houston • Indianapolis Los Angeles • Miami • Milwaukee • Minneapolis • New Haven • New York • Philadelphia • Pittsburgh • Portland, Oregon • Providence Rockford • Salt Lake City • San Francisco • Seattle • Springfield, Massachusetts • St. Louis • East Syracuse • Tampa • Toledo • Tulsa

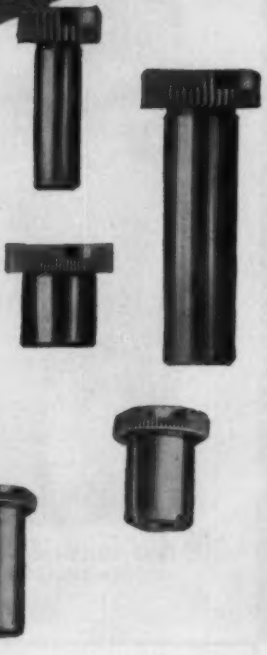
CIRCLE 216 READER SERVICE CARD

for accuracy in your production
it pays to specify

UNIVERSAL DRILL BUSHINGS

In Universal you get the best. Machined from finest quality steel. Blended radius on the top-inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip.

super-finish bores
lengthen tool life
The superfinishing of Universal Drill Bushings is an important factor in keeping tool and bushing wear to a minimum—especially in close tolerance work.



Standard sizes and lengths in stock for immediate delivery. Contact the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.

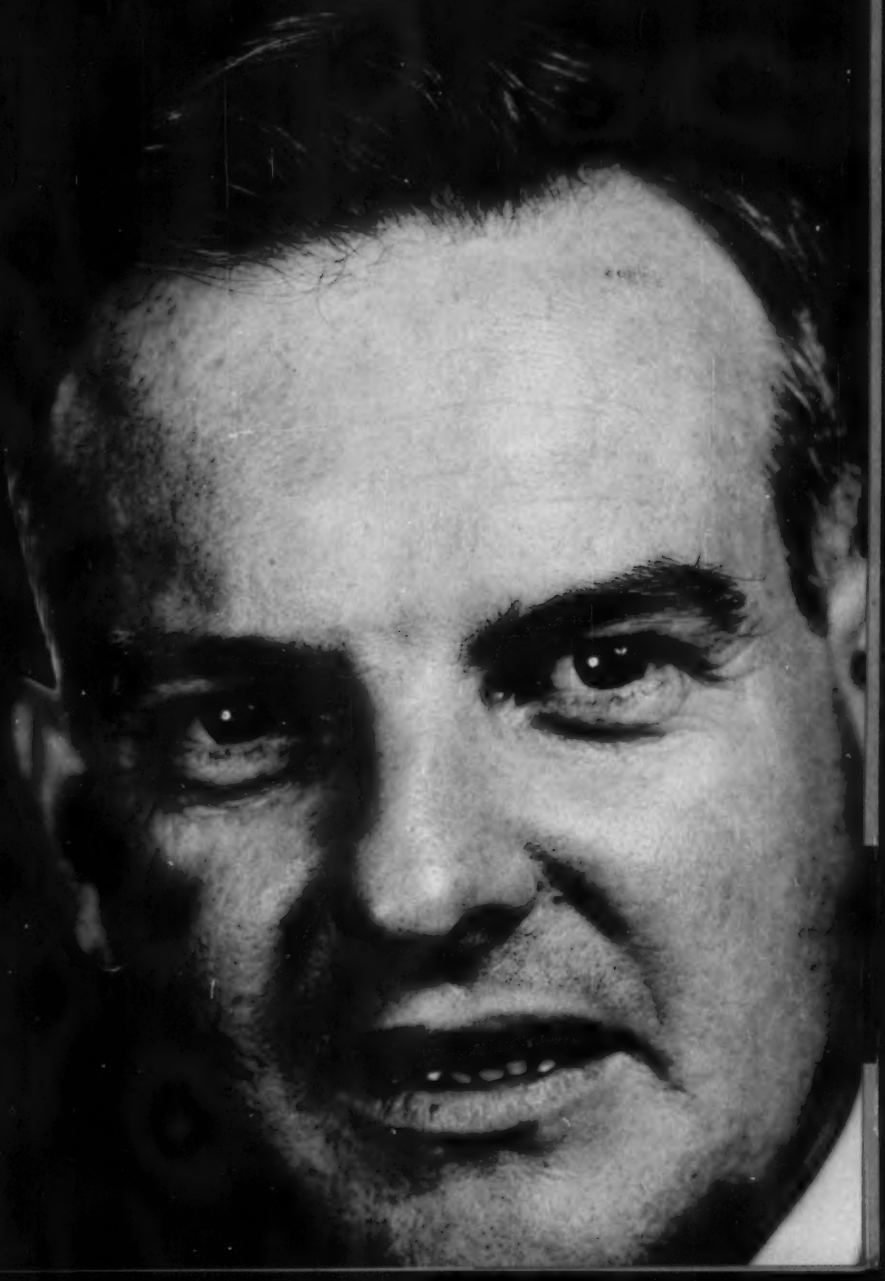
Write for your copy of our new 98 page catalog describing Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holder, Mikro-Lok Boring Bars, Standard Drill Bushings, Universal Index Plungers and other Universal products.

UNIVERSAL ENGINEERING COMPANY | **FRANKENMUTH 1, MICHIGAN**

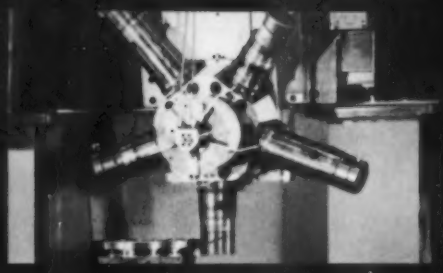
CIRCLE 217 READER SERVICE CARD ▲
CIRCLE 218 READER SERVICE CARD ▶

"WE'RE USING TAPE-CONTROLLED MACHINE TOOLS...

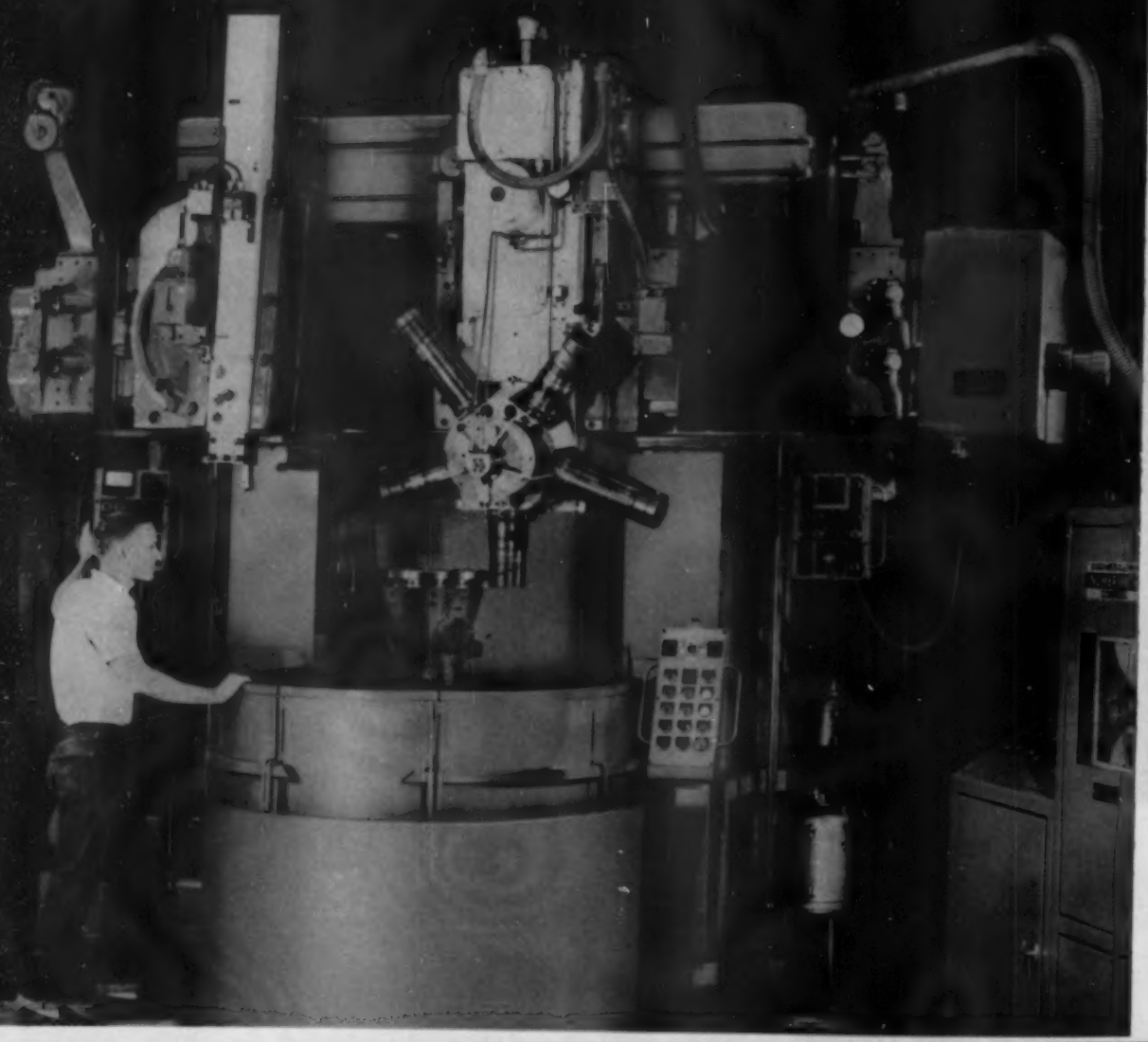
TO SERVE OUR CUSTOMERS FASTER...TO AID OUR SHOP PEOPLE IN MEETING COST, DELIVERY, AND QUALITY REQUIREMENTS...AND TO EXPAND OUR PRODUCTION WITHOUT ADDING FLOOR SPACE"



JOHN K. McGEE
MANUFACTURING ENGINEER
GRAY TOOL COMPANY
HOUSTON, TEXAS



WIDE RANGE OF ECONOMIC VALUES INVOLVED IN INSTALLATION OF FIRST CONTINUOUS-PATH TAPE-CONTROLLED MACHINE TOOL OUTSIDE OF AIRCRAFT INDUSTRY



Gray Tool Company, Houston, Texas, a leading manufacturer of specialized production equipment for the petroleum industry, recently installed the first magnetic tape path-controlled machine ever to be used outside of the aircraft industry — a 54″ Giddings & Lewis vertical boring mill.

The machine was purchased as part of a planned program designed to accomplish the following objectives:

- A manufacturing system to aid shop personnel in meeting cost, delivery, and quality requirements.
- Increased production with minimum capital investment.
- Better and faster service to customers.
- Assurance of reasonable profits while maintaining good wages and holding down prices in the face of continuing inflation.
- Reduction in inventory of processed or partially processed parts.
- Use of standard multipurpose machines to replace specialized equipment.
- Extensive use of economical throwaway carbide-tipped tooling.
- Ability at any time in the future to economically and accurately duplicate parts which might originally have been produced years before.

Ideal for short runs and short-notice orders. At Gray, short runs of a wide variety of parts are the order of the day. The range is one to 30 parts per run, the average three. Even so-called standard items must be supplied with many small variations to meet specific customer requirements. Another "must" in serving the oil industry is almost immediate delivery, even for a duplicate of a part made 20 years ago.

The G&L machine is meeting these requirements ideally because parts now can be machined to customer's order and shipped within a matter of hours.

Machine tool as a "sales tool." A valuable side effect of the installation has been its aid in selling customers on the capabilities of Gray, the quality of its products, and the speed with which urgent deliveries can be made. Executive personnel of a number of customers have visited the Gray plant specifically to witness the machine in operation on their parts and have come away well satisfied with their choice of a supplier.

Benefits for you in tape control. It will pay you to investigate Giddings & Lewis numerically controlled machine tools if your company is interested in any or all of the following: better production control . . . greater freedom in product design or styling change . . . shorter lead time . . . major reductions in jig and fixturing costs . . . reduction in finished or partially finished parts inventories . . . greater all-around economy and flexibility on short-run production.

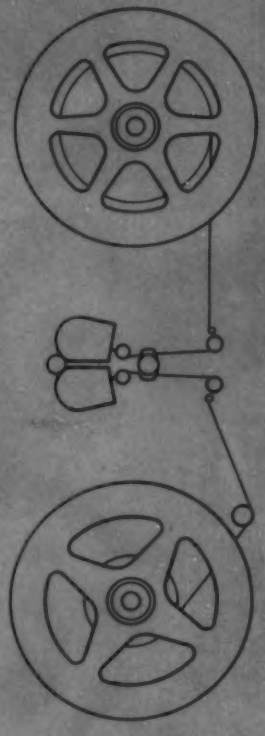
Call your local G&L distributor or write direct.

GIDDINGS & LEWIS

GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wis.

GIDDINGS & LEWIS NUMERICAL CONTROL

—The means to automation of short run production



GIDDINGS & LEWIS

SEE BACK PAGE

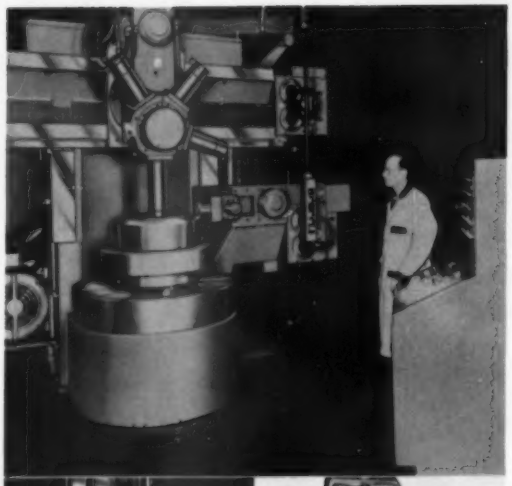
HIGHLY CONTROLLED VERTICAL TURNING AND BORING MACHINES FOR EVERY JOB

TAPE CONTROL • DUPLI-TRACER PENDANT • PUSHBUTTON • "JOY-STICK" ELECTRONIC READOUT

The Giddings & Lewis Numeripath magnetic tape-controlled vertical boring mill described on the preceding pages is but one of a complete line of G&L vertical turning and boring machines available with control systems to best meet the requirements of any shop.

The standard line includes machines having tables from 32-inch to 20-foot diameters. Illustrated at the right is a Giddings & Lewis 42-inch vertical turret lathe operated by G&L Numeripoint punched paper tape discrete positioning control. This machine is available with a five-position turret head and a right side head which can be equipped with four separate tools. Tape control indexes and positions all nine tools and regulates head feeds and table speeds for complete automatic machining.

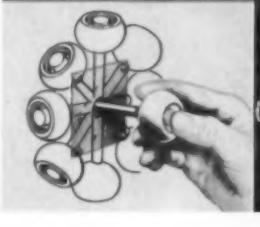
Also illustrated are other advanced controls available on Giddings & Lewis vertical boring and turning machines to greatly increase productivity and reduce manufacturing costs. For complete information, call your Giddings & Lewis distributor or write for literature.



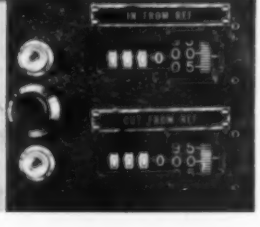
Electronic or hydraulic Dupli-Tracer controls.

Complete pendant control of all machine functions.

"Joy-stick" control moves the head the direction you move the stick.



Electronic readout to .001" from easily set zero reference points.



GIDDINGS & LEWIS

GIDDINGS & LEWIS

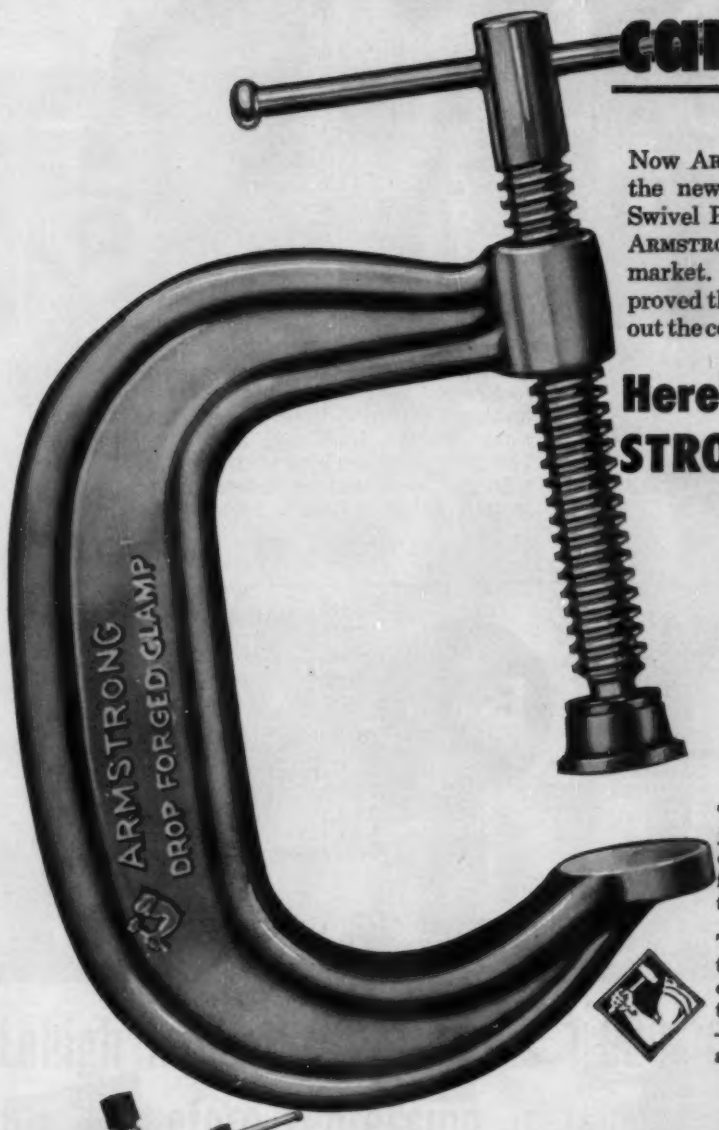
GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wis.

Jig borer and milling machine; horizontal boring, drilling, and milling machines; vertical turret lathes; vertical boring mills; positioning tables; die sinking machines; contour milling machines; radial and upright drilling machines; planers; planer mills; numerical and tracer control systems: Davis boring tools.

*Numeripath, Numeripoint and Dupli-Tracer are Giddings & Lewis trade-marks.

V-200 Printed in U.S.A.

New ARMSTRONG Swivel Pad can't come off



Now ARMSTRONG deep throat "C" Clamps have the new (Pat. apd. for) ARMSTRONG Ball-joint Swivel Pad. This "C" Clamp pad, developed by ARMSTRONG Engineers, is tougher than any on the market. Rigorous testing in our own plant first proved this fact, and field tests in factories throughout the country have confirmed our own test results.

Here's Why it's STRONGER . . .

The lip of the opening in the ARMSTRONG Ball-joint Swivel Pad is undercut so that when the ball of the screw is inserted, and the lip is permanently forced down, a solid steel wall is formed, inside the pad cavity, completely encircling the ball.

This wall of steel makes it impossible for the pad to come off the screw during normal use. In fact, our tests have proved that it is virtually impossible to intentionally knock the pad off with a hammer —yet the pad is free to swivel through an arc of approximately 40°.

Call your ARMSTRONG Distributor

Your ARMSTRONG Distributor can offer delivery from stock on this "400-Series" deep throat, drop-forged "C" Clamp with the new Ball-joint Swivel Pad. He also carries in stock the other styles of clamps in the ARMSTRONG Line—the broadest line of drop forged "C" Clamps.

ARMSTRONG BROS. TOOL CO.,

5215 W. ARMSTRONG AVE.
CHICAGO 46, ILLINOIS

◀ CIRCLE 221 READER SERVICE CARD

▲ CIRCLE 222 READER SERVICE CARD

THERE'S A

CLEVELAND

FOR YOU IN THIS

ADVANCED, COST-CUTTING

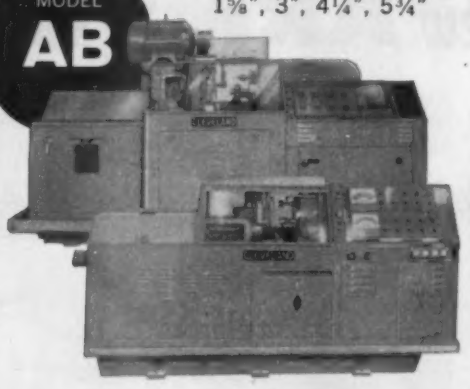
LINE OF SINGLE SPINDLE

AUTOMATICS

DIALMATICS

1⅝", 3", 4¼", 5¾"

MODEL **AB**



Dialmatics are the ultimate of single spindle design. On all sizes, infinitely variable turret tool feeds are set electronically by turning knobs. Feed monitor dial indicates exact rates. On the 1⅝" size, infinitely variable spindle speeds are also set by turning knobs, with rpm indicated on speed monitor. Dialmatics cut setup time to bare minimum!

AUTOMATICS

2½", 4¼", 5¾"

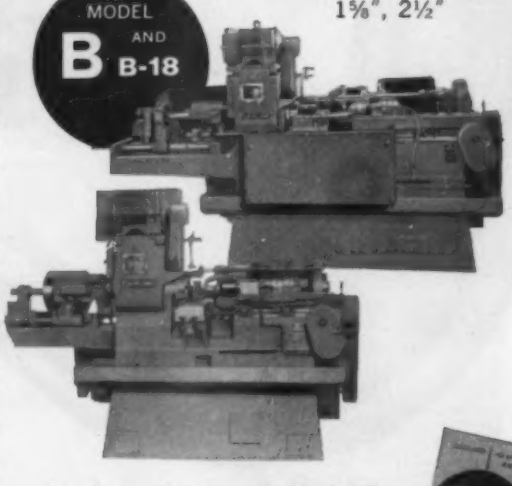
MODEL **AW**

AW's are simplified, lower cost automatics that differ from the AB Dialmatics only in that variable turret feeds are obtained by an improved mechanical drive. These are the "work horse" automatics of many shops.

BAR AUTOMATICS

1⅝", 2½"

MODEL **B** AND **B-18**



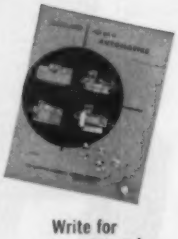
In place of a turret, Model B tooling is mounted on a flat milling slide and on two cross slides. Ideal for making studs or for shaft work involving multiple diameters, shoulders, etc. Model B-18 handles work up to 18" long.

AUTOMATIC

8"

MODEL **A**

Powerful, heavy-duty Cleveland machines parts from stock up to 8" dia. with ease and accuracy. Universal camming shortens set-up time.



Write for new general bulletin.

For full details on Clevelands best suited to your requirements, write direct, or call in a Cleveland field engineer.

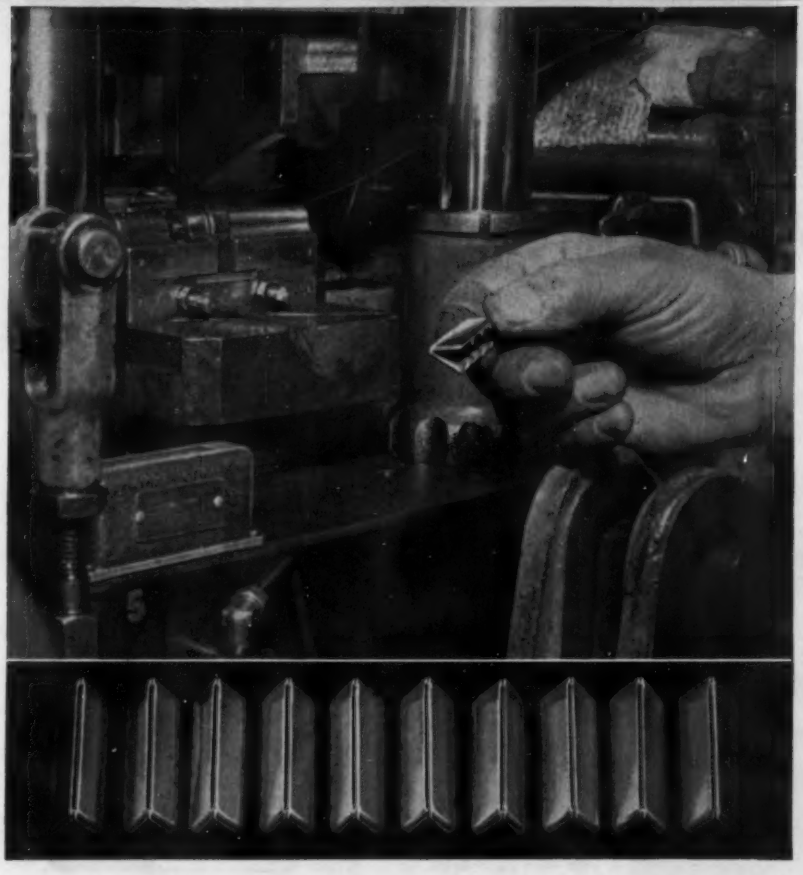
Sales Offices: Chicago • Cleveland • Detroit • Hartford • Springfield, N.J.

CLEVELAND AUTOMATIC MACHINE COMPANY

4928 Beech Street • Cincinnati 12, Ohio

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

Tool Steel Topics



Lehigh H blanks and forms 1,000,000 pieces before redressing is necessary

Using a die of Bethlehem Lehigh H tool steel, Sobel Metal Products Co., Easton, Pa., produced this nickel-silver belt accessory, of the type used with army uniforms, at the rate of about 1,000,000 pieces before redressing was necessary. Blanking and forming .020-in. metal, the die was hardened to Rockwell C60-61. One of the requirements of the order was that no marking was permitted on the finished part.

Lehigh H (AISI D-2) is excellent tool steel for jobs like this. Not only is it the leader in machinability among the high-carbon, high-chromium tool steels sold today — it also has improved wear-resistance because its vanadium content has been increased to 1 pct.

As the result of a new manufacturing process, Lehigh H has improved carbide distribution and increased center density. It also has minimum distortion during heat-treatment.

If you want unexcelled machinability, excellent wear-resistance, and plenty of dependability, Lehigh H is your answer. See your Bethlehem tool steel distributor for prompt delivery.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Blind Holes Can Cause Plenty of Trouble

Unless one uses great care, blind holes can cause a lot of trouble when heat-treating tools. Holes for studs or dowel pins are typical of the blind holes which, as a rule, are paid little attention. Exposing blind holes to liquid quenching produces extremely high internal stresses, which can lead to cracking of the tool, either during heat-treatment or in service.

If it is not necessary for blind holes to be hard internally, these difficulties can be avoided by packing the holes prior to the quench, using clay, asbestos rope, steel wool, or a steel plug.

Blind holes are particularly objectionable if they must be uniformly hard on the inside surface. The only way to meet this requirement consistently is to select a grade of air-hardening tool steel.

Be Sure to Try Red Sabre Tool Bits

You're sure of economical cutting when you use Bethlehem Red Sabre Tool Bits, regardless of the type of application. Red Sabre is a super high-speed steel, with about 1.50 carbon, 12.00 tungsten, 5.00 vanadium, and 5.00 cobalt. The bits have high red-hardness and uniform hardness all the way through, for peak resistance to wear and maximum cutting ability. They come hardened to Rockwell C65.

CIRCLE 224 READER SERVICE CARD

Off-the-shelf delivery of Carmet® Carbide Tools from your local CARMET Distributor

Over 75 distributors, coast to coast, display this sign—service in your own local area.

Keep your inventory of Carmet Carbide Tools at a comfortable level. Keep your working capital free for other needs. Your Carmet distributor carries the load—that's how he's set up to do business.

He carries your needs from the complete line of Carmet Carbide Tools in all grades and every style. He is geared to deliver your orders quickly—a phone call gets action.

And if you get in a production jam, special service is his middle name. Remember, your Carmet distributor knows carbide tooling—with the help of the local Carmet technical man, you get all the help you need.

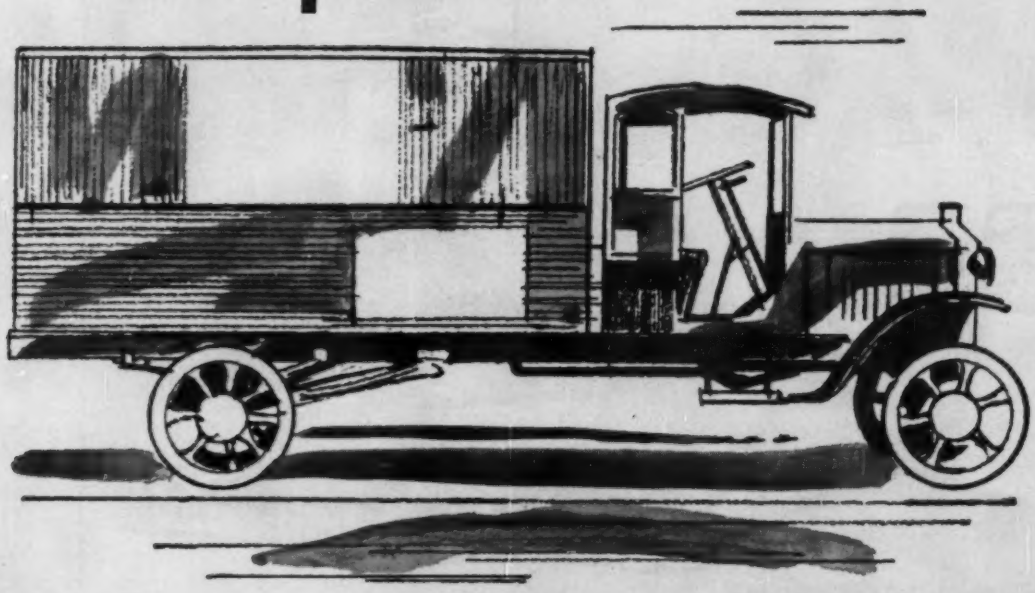
Your Carmet distributor handles the best Carbide Tools and backs it with the best service! ***Allegheny Ludlum Steel Corporation, Carmet Division, Ferndale, Detroit 20, Michigan.***

CARMET® AL

CEMENTED CARBIDE • DIVISION OF ALLEGHENY LUDLUM

1800

Delivering lo$t profit$?



You can't afford to deliver your goods in obsolete equipment; that would be poor economy and tough on your name.

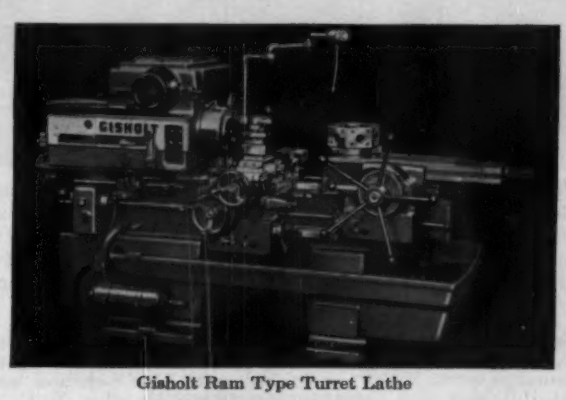
But what about obsolete production equipment? It's out of sight, but it delivers a far greater loss in wasted time and manpower, excessive unit costs and reduced quality.

You might be surprised how easy it is to turn these losses into profits with the many production advantages of a modern Gisholt Turret Lathe.

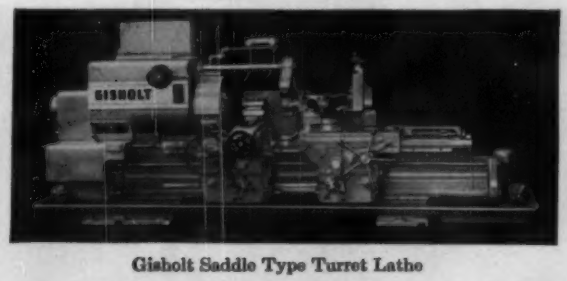
Here is the capacity with the versatility you need to cut critical unit costs on a wide variety of tough jobs. Here is the easy operation you need with the easy setup to minimize tooling and change-over time. Here is the extreme accuracy you need to maintain closest tolerances and highest quality. Here is the extra power with the rigidity to take full advantage of modern cutting tools.

Here are all the advantages you need to keep ahead of demands for higher, faster production and lower costs.

Ask your Gisholt Representative about Gisholt Ram and Saddle Type Turret Lathes—how they can be put to work in your plant earning extra profits, paying for themselves. Call him today or write for literature.



Gisholt Ram Type Turret Lathe



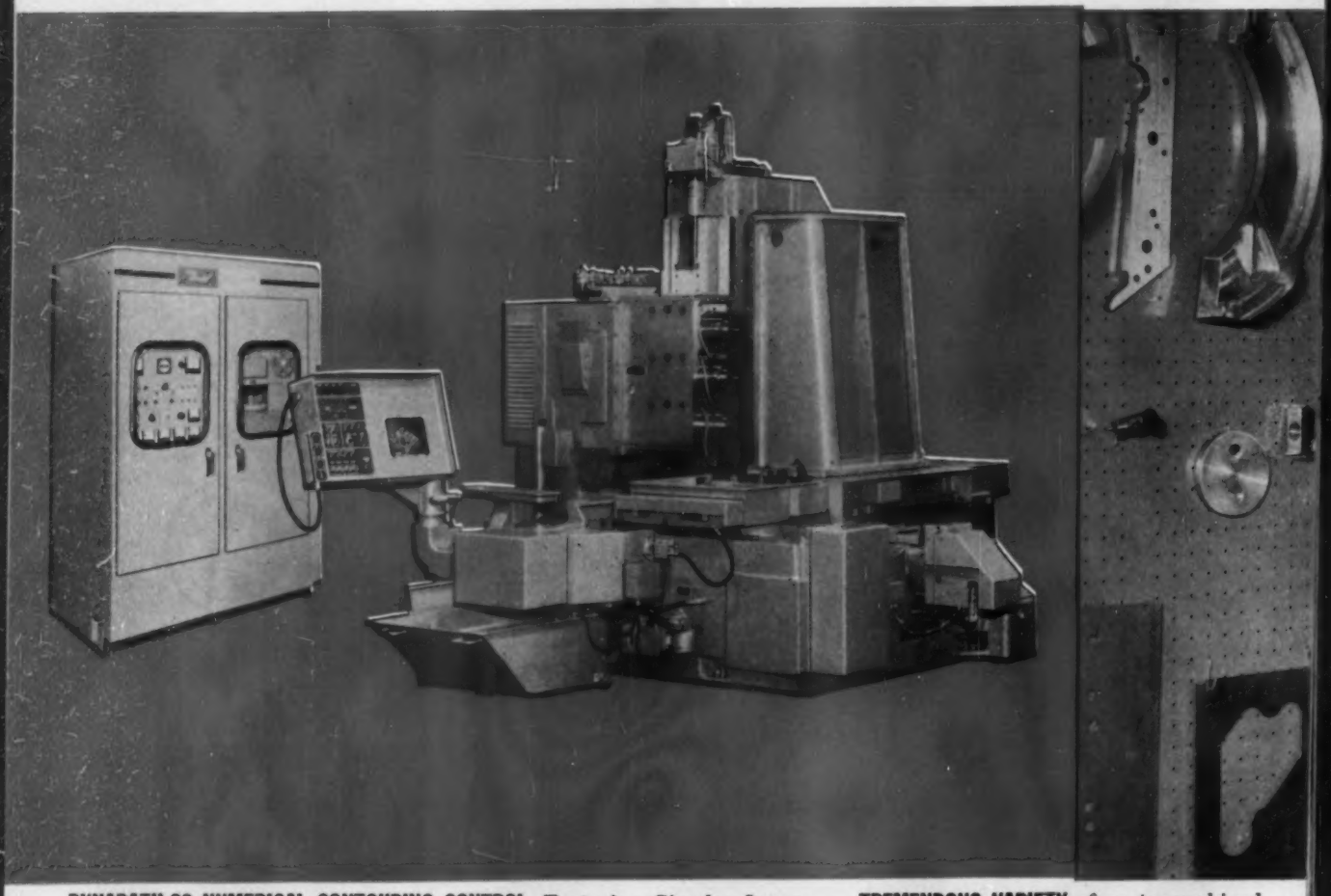
Gisholt Saddle Type Turret Lathe

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

Investigate Gisholt's Extended Payment and Leasing Plans

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Machines
• *Factory-Rebuilt Machines with New Machine Guarantee*

NOW—BENDIX OFFERS COMPLETE LINE

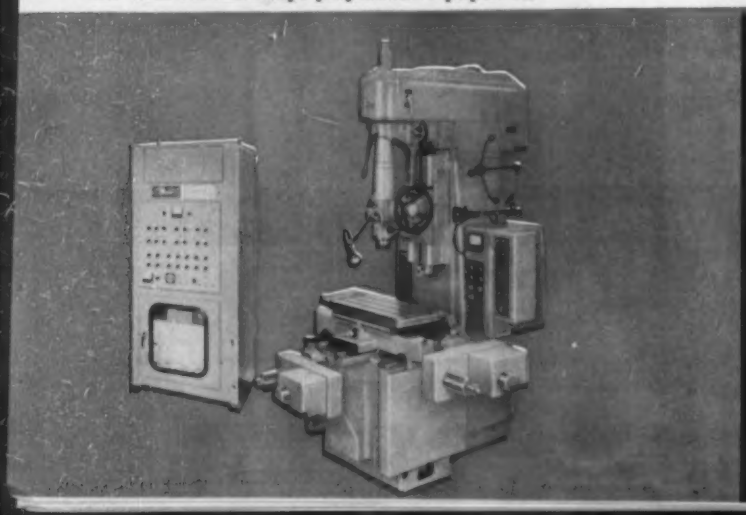


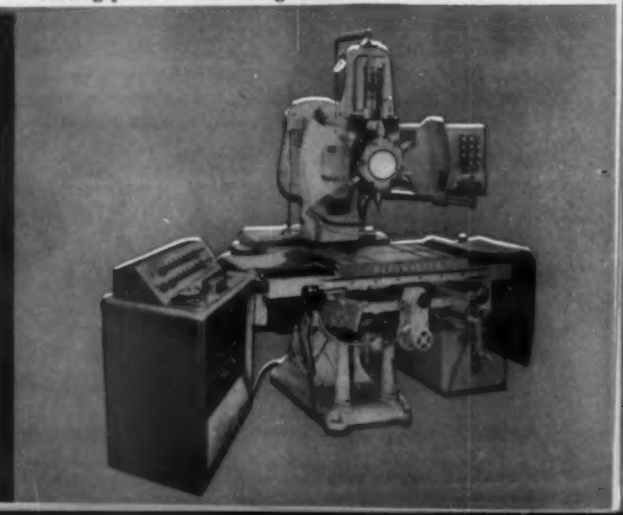
DYNAPATH-23 NUMERICAL CONTOURING CONTROL. Featuring *Circular Interpolation* to permit the close-tolerance machining of arcs and circles, as well as straight lines, with a minimum of input data. Offers 0.0002-inch resolution on 2, 3, or more axes of control. Each application individually engineered for the best possible combination of machine tool and control unit.

TREMENDOUS VARIETY of parts machined with Bendix numerical control shown here. Parts range from complex missile components to simple but extremely accurate cams.

DYNAPOINT-22 NUMERICAL POSITIONING CONTROL. Provides the finest electronic resolution available anywhere—0.000010″ for jig borer accuracies within 0.0001″ on finished parts. Uses 8-channel binary-coded decimal tape format—compatible with other N. C. units and with standard tape preparation equipment.

FERRANTI FP-22 NUMERICAL POSITIONING CONTROL SYSTEM. Floating zero for fast, easy set-up and low-cost tooling. Dial input provides manual operation flexibility. Wear and loss of accuracy eliminated because there are no contacting parts in measuring units.





OF NUMERICAL CONTROLS

New, completely transistorized POSITIONING and CONTOURING units provide greater reliability, lower operating costs and made-to-order accuracy.

Tested and proven in scores of installations, over thousands of productive hours, Bendix numerically controlled contouring systems have become recognized as the finest. Based on this solid history of achievement, The Bendix Corporation now introduces its second generation control systems, the DynaPath-20 Series Numerical Contouring Controls, and the Dyna-Point-20 Series Numerical Positioning Controls.

To further extend its broad coverage of the numerical control field, Bendix has obtained exclusive rights to distribute the Ferranti tape controlled positioning units and Ferranti's unique coordinate measuring machine.

Bendix backs up the most complete line of numerical control equipment with the best and most complete service organization in this country. From application engineering through tape preparation, customer training and field service, Bendix has had more teamwork experience than has any other electronic controls manufacturer in the field.

Only at Bendix can the machine tool builder and user find everything he needs for numerically controlled manufacturing. Why not investigate Bendix PACKAGED PRODUCTIVITY today.

FERRANTI FI-22 COORDINATE MEASURING MACHINE. Checks workpieces up to ten times faster than conventional methods. Direct and continuous readout (in ¼-inch figures) of hole center locations with one-set-up simplicity. Accuracy of ±0.001″ over entire 15″ x 24″ range.

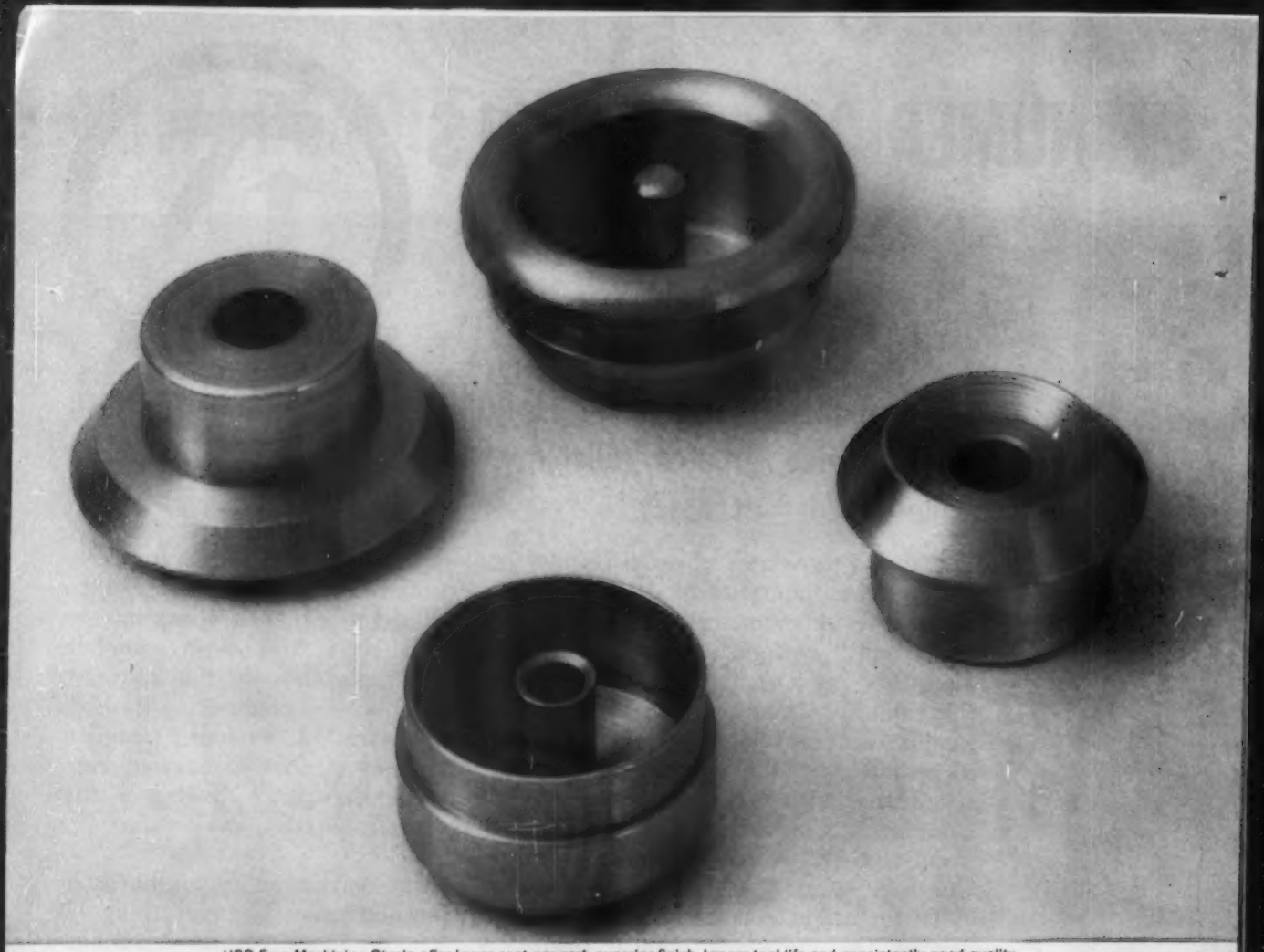
THE Bendix CORPORATION

Industrial Controls Section

21820 Wyoming, Detroit 37, Michigan

For additional information on Bendix Numerical Control and Measuring Equipment, please write to Bendix at the above address.

CIRCLE 228 READER SERVICE CARD



USS Free-Machining Steels offer lower cost per part, superior finish, longer tool life and consistently good quality.

Why USS Free-Machining Steels offer lower final costs

When you standardize on USS Free-Machining Steels, you get *consistently* good performance in your machines. This holds true for either the well-known USS MX Brand or the new USS Leaded Steels. Faster cutting speeds, longer tool life, less down-time and bigger output result in lower final costs.

Why USS Free-Machining Steels offer more. Good steelmaking practices from start to finish, which are the rule in United States Steel, produce a *uniformly* high-quality bar stock with machinability in the upper part of the range expected with these grades.

Close control of chemical balance, and rolling and finishing practices are combined with high inspection standards to produce a bar stock that has excellent surface and internal conditions. Therefore, such stock will not cause early tool failure but will permit maximum machinability of the particular grade to be fully realized.

So, whether you prefer USS Leaded Steels, or the well-known USS MX Steel in open hearth or Bessemer, you will get the highest quality from United States Steel. USS Free-Machining Steels are available in all screw stock sizes. Whatever your cold finished requirements, specify USS Free-Machining Steels from your cold drawer. For more information call our nearest district sales office, or write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

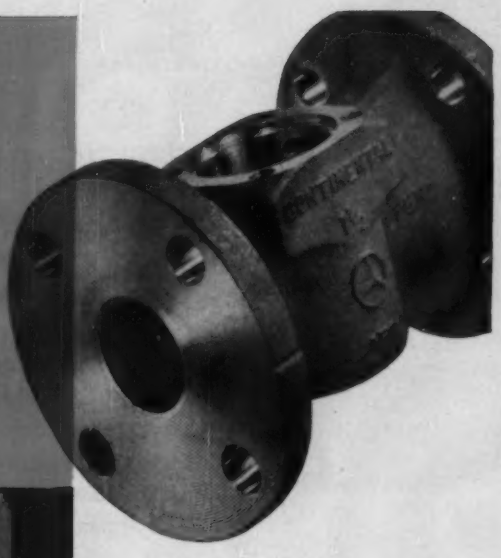
USS and MX are registered trademarks

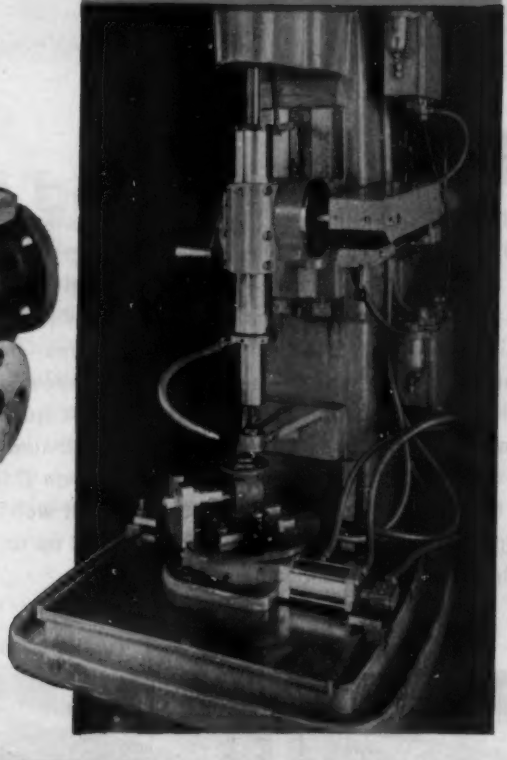
United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company
United States Steel

This mark tells you a product is made of modern, dependable Steel.

HERE'S DRILLING AUTOMATION ...dirt cheap!

In this case, on valve body flanges*





Problem: "On this Continental Manufacturing job, we have various valve body sizes in tough-machining materials, hole diameters to ¾", and small lot runs up to 25 pieces. To make it a profitable operation, we must have low-cost equipment with fast setups for quick changeovers."

Answer: Standard 21" CINCINNATI, "tailored" with standard air-operated feed and table indexing . . . simple, flexible fixturing for approximately 5 minutes setup time . . . 2½ to 5 minutes cycle time depending on material . . . total equipment cost slightly under $4000!

Let Cincinnati Lathe and Tool service engineers tailor a versatile new CINCINNATI Drilling Machine *to suit your needs exactly!* You get a specialized unit made with the right combination of standard accessories—the most practical approach to LOWEST COST PER DRILLED HOLE!

The story of another of many shops, large and small, who have brought their drilling problems to our service engineers for help. Ask your Cincinnati Lathe and Tool Dealer for service engineering on your drilling problem. If you can't reach him immediately, wire us—collect!

cincinnati lathe and tool co.

Cincinnati 9, Ohio

HYDRASHIFT Lathes • CINCINNATI Drilling Machines
SPIROPOINT Drill Sharpeners

OUTSIDE...

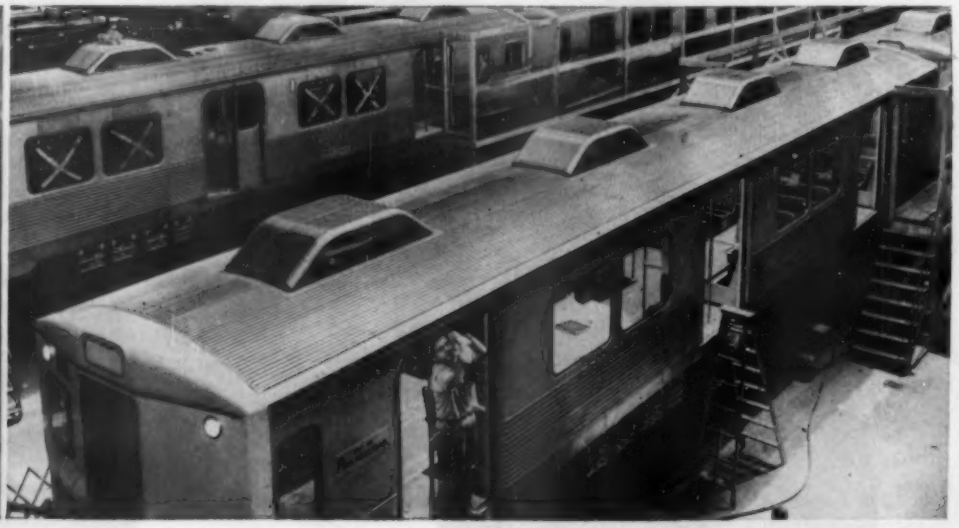
It's literally true that Stainless Steel trailers do not wear out before they become obsolete. Some of them have logged over a million miles. Once, a load of lampblack in a Stainless trailer caught fire and burned for five hours. Wheels, bearings, brake linings, drums (and cargo) were completely destroyed. They were replaced and the trailer body is still in service.

Water, harsh marine or industrial atmospheres can corrode and rot trailer bodies of other materials. Not Stainless. And Stainless Steel is strong—it has a yield point almost four times greater than competitive materials, so Fruehauf engineers (who designed this trailer) can design thinner, lighter walls, roof and braces. Strength goes up, and so do payloads and profits. Maintenance costs go down. The trailer shown here is 40 feet long, is built of type 302 Stainless, and is the strongest, lightest trailer in its class.

INSIDE...

In Philadelphia, 270 sleek new Stainless Steel subway-elevated cars are in process of going into service, with more than 100 already running. Manufactured by The Budd Company of types 201 and 202 Stainless, they were designed to win new riders to mass transportation, yet they will be cheaper to operate and maintain than any similar rapid transit cars ever built.

These cars will be exposed to all kinds of atmospheres—from the dampness of the underground tunnels to the sleet, rain, snow or hot sun above ground. But they'll always look new and shiny—because they're Stainless Steel. A quick hosing-down will keep them looking that way, and costly painting will be eliminated because Stainless Steel keeps its good looks. And the Philadelphia Transportation Company will save in other ways too: since these new cars weigh only 49,000 lbs., it won't take as much power to run them. Savings in maintenance and operation will add up to some $6,500,000 over the 30-year depreciated lifespan of the fleet.



...and in between

Only Stainless Steel offers designers and fabricators this unique combination of properties: great strength, extraordinary corrosion resistance to an enormous variety of reagents, outstanding high temperature properties, and good appearance. It is easily fabricated, and it actually costs less in the long run because it lasts longer. For unmatched efficiency, durability, ultimate economy, specify Stainless Steel. For a wide selection of Stainless Steels and for prompt delivery ask your USS representative or nearest steel service center.

USS is a registered trademark

This mark tells you a product is made of modern, dependable Steel.

United States Steel Corporation – Pittsburgh
American Steel & Wire – Cleveland
National Tube – Pittsburgh
Columbia-Geneva Steel – San Francisco
Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Supply – Steel Service Centers
United States Steel Export Company

United States Steel

Stainless Steels . . . no other metal makes such a material difference in so many applications

Finish
SQUARE
HOLES
Faster... At Far
Less Cost... with

Minute Man®
SQUARE
BROACHES

Starting with a round pilot, you can finish an *accurate* square hole in a drilled, reamed or cast bore in one *pass* in *less than one minute* with a Minute Man Square Broach.

Used in a hand-operated or hydraulic press, these High Speed Steel Push Type broaches are ideal for putting square holes in boring bars, for jig, fixture and die work and for square coupling work.

They are available from stock in seventeen standard sizes from ⅛" square to ¾" square.

More Time-And-Money-Saving
Minute Man BROACHES

Hexagon Broaches, for holes from ⅛" Hex to ¾" Hex, offer the same production advantages as square broaches.

Production Type Keyway Broaches speed the quantity production of keyways in a specific diameter of bore. For keyway widths up to ¼" and body diameters up to 1".

Keyway Broach Kits for cutting keyways from 1/16" to 1" in any bore from ¼" to 3" in *one minute* for as little as *one cent* each.

The duMONT CORPORATION
Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST A describing Square Broaches, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name.....
Company.....
Address.....

LETTERS

to the editors

330 W 42nd St, New York 36, NY

Arc-Spot Gun

Dear Sirs:
Would you kindly send us the correct address of Bren Weld Corp? You had an item in "Metalworking Report" (*AM/MM*—Sept 5 '60, p2), and I would like to send for more information concerning the gun for arc spotwelding.

F. Kennedy
Waterbury, Conn

Dear Sirs:
Our letter to Bren Weld Corp, Brooklyn, NY was returned for insufficient address. Would you be so kind as to type the correct address on the enclosed stamped envelope and forward it for us?

R Ford
Indianapolis, Ind

The Bren Weld Corp is located at 5114 Third Ave, Brooklyn 20, NY —Ed.

Rub-on Solder

Dear Sirs:
Please send me the address of the All-State Welding Alloys Co, Inc, developers of the fluxless aluminum rub-on-solder reported in your "Metalworking Report" (*AM/MM*—Sept 5 '60, p3).

R. Bellovich
Staunton, Ill

All-State Welding Alloys Co, Inc, is located at 249-55 Ferris Ave, White Plains, NY—Ed.

No Move Planned

Dear Sirs:
We would like to know the source of your information for an item in your "Field Report" (*AM/MM* —Sept 19 '60, p203):

"Detroit Tool & Die Co, Detroit, will begin operations this month in its new Hartsville, Tenn, plant."

We, the Detroit Tool & Die Co, Detroit, are not moving, nor do we anticipate opening any branches outside of Detroit.

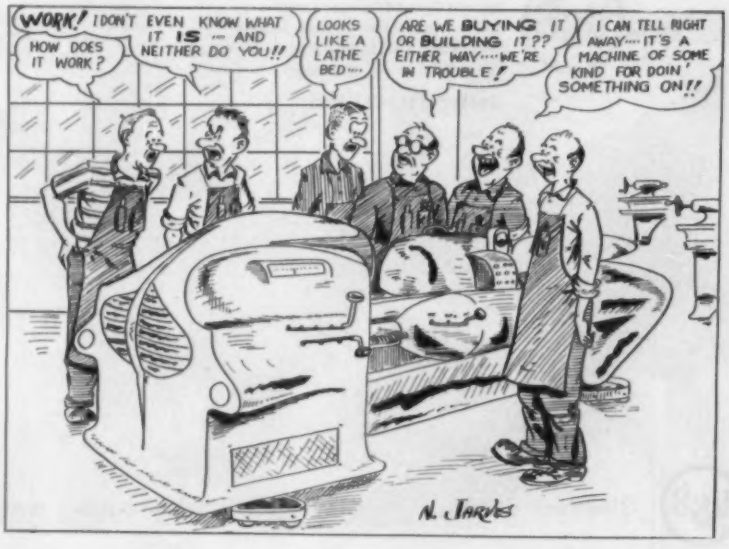
This rumor is causing quite a disturbance, and we are anxious to learn of its origin.

Roy L Neveau, gen mgr
Detroit Tool & Die Co
Detroit, Mich

Needless to say, the report was mistaken, but we accepted it in

SHOPMATES

N. Jarvis


WORK! I DON'T EVEN KNOW WHAT IT IS — AND NEITHER DO YOU!!
HOW DOES IT WORK?
LOOKS LIKE A LATHE BED...
ARE WE BUYING IT OR BUILDING IT?? EITHER WAY.... WE'RE IN TROUBLE!
I CAN TELL RIGHT AWAY.... IT'S A MACHINE OF SOME KIND FOR DOIN' SOMETHING ON!!
N. JARVIS

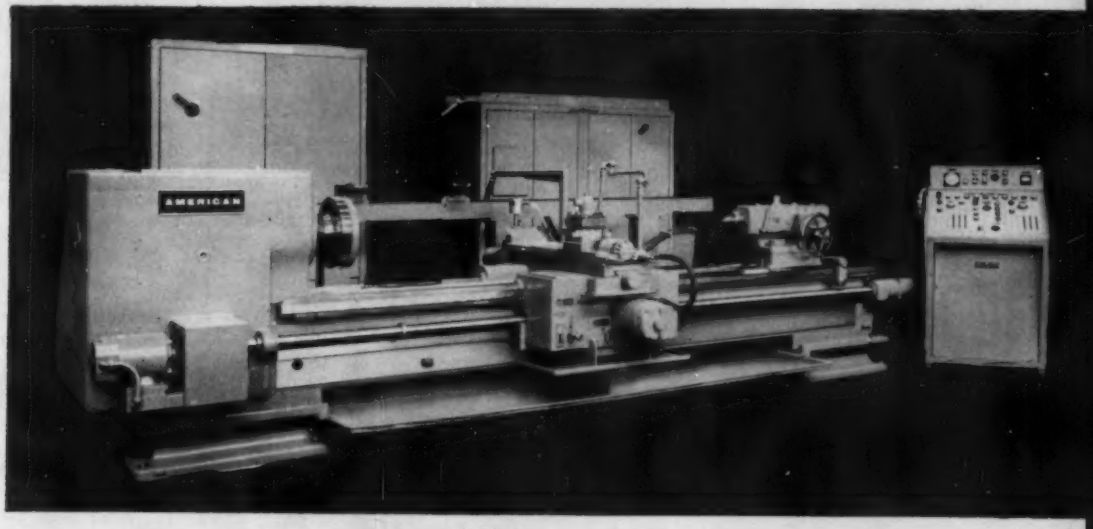
IT'S NEW
IT'S VERSATILE
IT'S AMERICAN

. . . and it's designed from the ground up to give you faster, more economical, more automatic production.

Here's a production athlete with both muscle and brains. A punched tape keeps it humming. 20 spindle speeds and 20 feed rates, tape selected. Spindle drive by a 50 H.P. constant variable speed reversing motor. Square turret is tape controlled. Lathe has hardened and ground cross and longitudinal Ball Screws. Tape preparation requires no computers. Simple to operate. Error free. Write for Bulletin 912-A.

THE AMERICAN 2509 TAPE CONTROLLED LATHE

TURNING • BORING • FACING



This and all other AMERICAN machine tools are available on "Toolease," our popular leasing plan. Send for Bulletin 801 for details.

COMPETE COMPETENTLY WITH

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LATHES • RADIAL DRILLS
SPECIAL MACHINES

The American Tool Works Company

Pearl Street at Eggleston Avenue • Cincinnati 2, Ohio

CIRCLE 234 READER SERVICE CARD

Checking surface flatness **down to 1/10 of a band?** (.000001-inch) You can do it easily with the

Unretouched photo of VK Optical Flat, the "A" section Micro-Koted, the "B" section untreated.

VAN KEUREN MICRO-KOTED* OPTICAL FLAT

Elimination of the fuzzy edges of the interference bands gives you *greater precision* and *readability*... and faster checking, too, because you get the pattern quicker. There's stronger contrast, a brighter field. The narrow band, very black and sharp-edged, has a width corresponding to a height difference of about .000001".

Having several times the effectiveness of ordinary flats, you might think that VK Micro-Koted Optical Flats are expensive — but that's where you'd be wrong. They cost only 10% to 15% more than uncoated flats. They do not require special handling; they have amazingly long life. One user checked more than 10,000 pieces of permanent magnetic material (carbon seals and Alnico seals) without any appreciable wear. Speaking of VK Micro-Koted Flats, one man said, "It makes a hell of a difference! We wouldn't buy a flat *unless* it was Micro-Koted!" That's the kind of compliment that makes us do our best!

Originated by Van Keuren in 1957, these Micro-Koted flats are perfect for checking bronze, brass and other metals used for magnetic seals, and for checking other critical parts, for surface flatness.

Write today for descriptive leaflet, "Micro-Koted Flats".

* VK Micro-Koted Optical Flats are treated on one side with a transparent layer of hard metal.

THE VAN KEUREN CO.
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
... rated the world's most accurate

Plug Gages • Measuring Wires • Optical Flats and Light Wave Equipment • Gage Blocks
Precision Lapping Service and Parts

good faith, as did several other people in our chain of information.

Here's how it happened, as explained by the State of Tennessee's Division of Industrial Development:

I certainly beg your apology for the error that we printed in our August 1960 NEWS concerning the tool and die plant at Hartsville. The information we obtained on the plant came from one of our local newspapers, and they erroneously reported the plant as the Detroit Tool & Die Co.

I have checked with the mayor of Hartsville, and, according to his report, Kenneth Hackett of Detroit, Mich, will own and operate the plant. The plant is unnamed at the present as it is not yet incorporated but is expected to be shortly.

I can assure you that in the future we will try to avoid errors of this sort and thus avoid putting persons in awkward positions.

Thurman R Gregg, *editor—News*
Division of Industrial
Development

Brake Control

Dear Sirs:
We would like to have the address of General Automation Corp in order to seek more information on the Autobend control for friction-clutch brakes mentioned in "Metalworking Report" (*AM/MM*—Oct 3 '60, p2).

B J Galiger
St Louis, Mo

The Autobend control is manufactured by General Automation Corp, 40-66 Lawrence St, Flushing, Long Island, NY—Ed.

"I'd like to see you in my office, 'Angry Employee'!"

CALENDAR

American Society of Mechanical Engineers — Winter Annual Meeting, Nov 27-Dec 2, Statler Hilton Hotel, New York, NY.

Joint National Symposium on Reliability and Quality Control, Jan 9-11, Bellevue Stratford Hotel, Philadelphia, Pa.

Society of Automotive Engineers —International Congress and Exposition, Jan 9-13, Cobo Hall, Detroit, Mich.

Instrument Society of America—Instrument-Automation Conference & Exhibit, Jan 16-19, Kiel Auditorium, St Louis, Mo.

Plant Maintenance & Engineering Show—Jan 23-26, International Amphitheatre and Palmer House, Chicago, Ill.

Society of Plastics Engineers—Annual Technical Conference, Jan 24-27, Shoreham Hotel, Washington, DC.

Society of the Plastics Industry —Reinforced Plastics Div Conference, Feb 7-9, Edgewater Beach Hotel, Chicago, Ill.

Material Handling Institute — Pacific Coast Show, Feb 22-24, Cow Palace, San Francisco, Calif.

Society of Automotive Engineers —National Automobile and Production Meetings, Mar 13-17, The Sheraton-Cadillac, Detroit.

American Society for Metals — Western Metal Show, Mar 20-24, Pan-Pacific Auditorium, Los Angeles, Calif.

Pressed Metal Institute — Spring Technical Meeting, Mar 22-24, Belmont Plaza Hotel, New York.

Society of Automotive Engineers —National Aeronautic Meeting, Apr 4-7, Hotel Commodore, New York, NY.

American Welding Society—Annual Meeting and Welding Show, Apr 18-20, Commodore Hotel and Coliseum, New York.

American Foundrymen's Society —Castings Congress & Exposition, May 8-12, Brooks Hall and Civic Auditorium, San Francisco, Calif.

MILLING ALUMINUM!

The best way to cut **ALUMINUM,** is with CARBIDE!

Carbide cuts faster, smoother, cooler and is much more economical, especially when milling **ALUMINUM!**

NELCO manufactures 121 different, "standard", off-the-shelf End Mills engineered for milling **ALUMINUM!**

ALUMINUM is a relatively soft material but it is one of the most abrasive.

Cutting tools that are not designed to mill **ALUMINUM** can make production very expensive.

NELCO manufactures the most complete variety of Carbide Cutting Tools, engineered to mill **ALUMINUM** and they are available through your Local Distributor.

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For that ***EXTRA*** *Edge in Production!*

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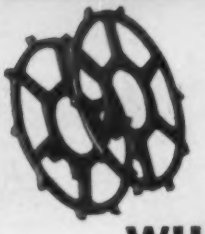


COMPETING WITH A COMPANY WHO GRINDS PARTS UP TO 50% FASTER?

If you are grinding parts like these on other than a Bryant Centalign® you are losing out to competitors who do.

This fact is proven by the many manufacturers who are setting production records and improving their competitive position—with Bryant Centaligns.

Only the Bryant Centalign with its advanced design principles enables you to grind straight bores, tapers and precision bearing raceways with consistent accuracy at record breaking production rates.

Investigate what the Bryant Model "C" Centalign and its tooling, job engineered for quick change over and minimum down time, can do for you.

Inquire, too, about the Bryant Vertical Centalign (for cam-type parts) and the Bryant Model B Centalign for miniature and instrument bearing work.

BRYANT Chucking Grinder Co.

10 CLINTON STREET, SPRINGFIELD, VERMONT

Internal Grinders • Special Machinery

GENERAL ELECTRIC

now!

Tri-Clad '55' motors with THERMO-TECTOR* system

WARRANTED

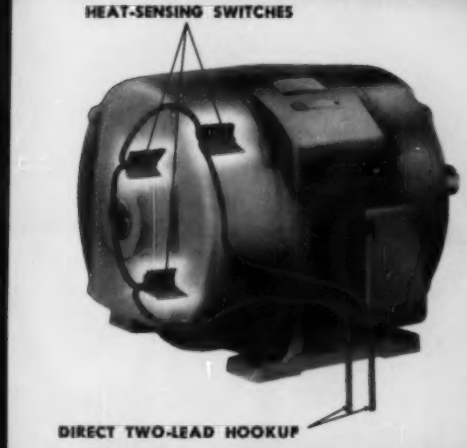
against burnout from overheating

For the *first time* General Electric offers you a motor with such *positive* protection it is WARRANTED in writing against overheating burnout!

G.E.'s exclusive new THERMO-TEC'TOR system gives Tri-Clad '55' motors truly *inherent* over-temperature protection. Unique variable shut-off feature allows motor to deliver *full power potential* under all operating conditions. Fail-safe THERMO-TEC'TOR system has simple, two-lead hookup.

*Trade-mark of General Electric Co.

For the first time General Electric offers you a motor with such *positive protection* it is WARRANTED against *overheating burnout*



TURN PAGE FOR FURTHER INFORMATION

NOW-A Motor *Warranted in Writing* Against Overload Burnout!

General Electric Company warrants to the Purchaser that the Tri-Clad '55' motor with Thermo-Tector system delivered hereunder will:

(a) Not burn out because of overheating resulting from overload, lack of ventilation, single-phasing, stall, high ambient, or voltage unbalance, as long as the Thermo-Tector switches are connected into the control circuit so that power to the motor is removed when an over-temperature condition occurs;

(b) Be free from defects in material, workmanship and title; and

(c) Be of the kind and quality designated or described in the contract.

The foregoing warranty is exclusive and in lieu of all other warranties whether written, oral, or implied (including any warranty of merchantability or fitness for purpose). If it appears within one year from the date of shipment by General Electric Company that the equipment delivered hereunder does not meet the warranties specified above and the Purchaser notifies the General Electric Company promptly, the General Electric Company shall thereupon correct any defect, including non-conformance with the specifications, at its option, either by repairing any defective part or parts or by making available at the General Electric Company's plant, a repaired or replacement part.

The liability of the General Electric Company to the Purchaser (except as to title) arising out of the supplying of the said equipment, or its use, whether on warranty, contract or negligence, shall not in any case exceed the cost of correcting defects in the equipment as herein provided and upon the expiration of said one year, all such liability shall terminate. The foregoing shall constitute the sole remedy of the Purchaser and the sole liability of the General Electric Company.

General Electric's *exclusive* THERMO-TECTOR system is available now on *all* Tri-Clad® '55' motors in frames 254U-445U. Contact your General Electric Apparatus Sales Office or Authorized Distributor *today* for details on this NEW FULLY WARRANTED MOTOR PROTECTION SYSTEM. Or, write for Bulletin GEA-7092, Section 866-04, Schenectady 5, N. Y.

SMALL AC MOTOR & GENERATOR DEPARTMENT

GENERAL ELECTRIC

SPOT NEWS...

- **Electrolytic dispersion hardening can double or triple the strength of soft metals,** reports General Electric. Process involves addition of an insoluble metal to a lower melting metal while it is in the liquid phase. By adding about 1.4% of molybdenum to molten copper, GE researchers came up with a yield strength of 21,000 psi for copper wire.

- **A contract for study and development of electron beam welding** of electrical connections for micro-assemblies has been awarded to Hamilton Standard's electronics department by the Army. A period on a typewriter is 100 times larger than one of the welds that must be made.

- **National Tool, Die & Precision Machining Association** is the new name decided upon by the 1000 member firms of the NTDMA. The change reflects the shift in defense work toward shorter runs of precision machined parts, and the consequent decline in use of dies, jigs, and fixtures.

- **A tool life formula developed in Sweden is reported to be more accurate** than the original Taylor formula or any of its refinements. Estimates of economical tool life calculated by Taylor's formula tend to be optimistic and unreliable for cost calculations, says Dr Bertil N Colding, who developed the new formula.

- **General Motors' new defense systems organization** will concentrate, at least initially, on the submarine detection field. Company may spend as much as $10 million annually to develop a system capability, which was considered much too costly for any of its existing divisions to provide out of individual division earnings.

- **Work has started in Britain on a remote-controlled machine shop** where operators will watch TV screens in a control room (which can be several miles away) and can carry out high-precision machining operations by turning knobs on a small control panel. No details have been released, but observers assume that beryllium or some other such toxic material is involved. Armstrong Whitworth Equipment, Gloucester, is the contractor.

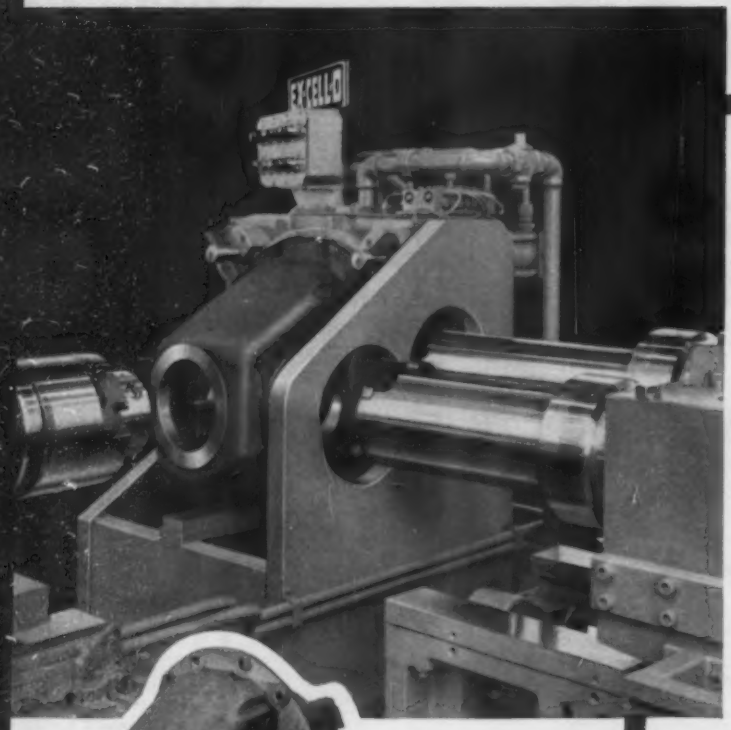
- **Three new chrome-plating processes** are about to be marketed by Diamond Alkali. One provides for direct plating of chromium onto aluminum or aluminum alloys; one for plating a brighter, more durable chromium onto a wide variety of base metals after an application of bright nickel plate; and the third produces a corrosion-resistant, crack-free bright chromium plate on aluminum as well as other base metals. All three Duramir processes are owned by General Development Corp, Miami.

- **Canada's big three of the automotive industry,** GM, Chrysler, and Ford, will sound out their American parent organizations for some form of production integration or reciprocal free trade, with a view toward cutting Canada's ailing automobile industry.

- **A light-alloy die-casting machine operated by pushbutton control** or automatic cycle was displayed by Officine Triulzi of Milan at the 10th International Technology Exhibition in Turin, Italy. A special preselector dial sets up to eight different work programs.

- **In its rapid growth during the next 20 years,** the United States will put into use a total volume of engineering materials (such as concrete, steel, wood, aluminum, glass, and other products) approximating the volume of all such materials produced here since the birth of the nation, said Dr A Allan Bates of the Portland Cement Association, speaking to an American Iron and Steel Institute meeting.

Ex-Cell-O Custom Machines Specialize in Difficult Jobs!

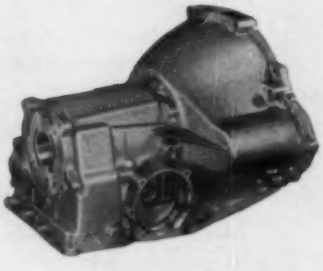


HEAVY-DUTY BORING—Custom Boring Machine uses three heavy-duty Ex-Cell-O Precision Spindles to simultaneously finish-bore four holes and bore-and-face a fifth hole in this 75-pound cast-iron housing in a 4½ minute cycle. Diameters are about 6"; tolerances are held within .001".

MULTI-DIAMETER BORING—In a single cycle, the long boring bar on this Custom Machine line-bores two holes while shorter bar below it bores a third diameter, and small spindle in foreground bores a dowel hole in this huge clutch and gear housing.

Whether you have a simple job that must be done faster and more accurately, or complex work that requires multiple machining operations, an Ex-Cell-O Custom Machine may be just the answer you've been looking for . . . the economical solution to a difficult production problem.

See your Ex-Cell-O Representative, or contact Ex-Cell-O's Machinery Division in Detroit for details on the limitless applications of Ex-Cell-O Custom Machines.



HIGH PRODUCTION—Aluminum transmission case shown above is turned 90°, rolled over 180° as it passes through a 24-station Custom Machine. Automatic operations include precision boring, facing, chamfering, radial milling, tapping, trepanning, air gaging and flushing. Output is 124 parts per hour.

EX-CELL-O FOR PRECISION

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • CONTOUR PROJECTORS • GAGES AND GAGING EQUIPMENT • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • ATOMIC ENERGY EQUIPMENT • RAILROAD PINS AND BUSHINGS • DAIRY AND OTHER PACKAGING EQUIPMENT

Machinery Division

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

60-31

WASHINGTON...

Overseas investment rises...

U S manufacturers are still boosting investment in production facilities abroad, especially in Europe. Latest Commerce Department statistics show that for all manufacturing, capital spending on facilities overseas averages 14% of what is invested at home.

Plant and equipment expenditures abroad by U S manufacturing firms total $1.3 billion in 1960, $200 million more than last year. In machinery manufacturing (excluding electrical), the rise is from $106 million in 1959 to $127 million this year. Electrical machinery is up from $88 million to $129 million. The increase in transportation-equipment manufacturing facilities is from $259 million to $327 million.

BAC views the economic outlook...

Get ready for more hammering on prices and more pressure on inventories. That's the word presented to government officials by the Commerce Department's Business Advisory Council, a group of 100 or so top executives from the nation's largest corporations.

Industry's top brass said that as far as general business is concerned, an upturn is in the works. They pooh-poohed talk of a recession, sounded more optimistic than their own expert professional economists, who met a few days ahead of the BAC and forecast a business turndown in the first six months of 1961, to be followed by a substantial economic rise.

The BAC members, however, were not as hopeful on corporate profits. They stressed the role of price reductions on 1960 profits, and most of them expect the trend to continue in the coming year.

GE's president, Ralph J Cordiner, BAC chairman, forecasts that "there will be more pressure on the price front." He sees this as the natural outgrowth of new productive capacity and the phase-out of inflationary fears.

Council members agreed with Treasury Secretary Anderson's estimate that the business holddown so far this year results chiefly from what he described as a "new tight-string policy on inventories."

Tax-Reform proposal fizzles...

The major tax-reform "package" proposal expected from Congress next year has fizzled. This was to have been the product of the House Ways & Means Committee's 18-month study of the measure. Representative Wilbur Mills (D-Ark), the committee's chairman, is now expected to await a wide-ranging tax-reform proposal from the new administration rather than propose his own package. The committee's voluminous expert testimony will be used as a basis for appraising what the new administration recommends.

Contractors' proprietary data...

The Pentagon is taking a long, hard look at the controversial issue of how much proprietary technical data it should acquire from contractors. Says one official: The objective is to "simplify and clarify" the policy.

A wide-ranging survey is being made of major defense installations and field agencies to determine their actual requirements for contractor's proprietary data at the operating level.

The military services have long been caught up in the dispute between (1) Congressmen who want unrestricted dissemination of proprietary data as a means of fostering broader competition on defense contracts, and (2) industry which seeks stronger protection for its proprietary secrets.

Up to now, the Defense Department has been reluctant to give in to the more extreme congressional pressures. Its broad view has been that a contractor's proprietary data should not automatically become government property.

Labor perspective...

A new management bargaining offensive may be shaping up in the wake of the GE-Westinghouse settlements with Jim Carey's International Union of Electrical Workers.

The major labor-contract negotiations for the year are winding up on a high note for employers. IUE settled the dispute on industry's original offer made before the three-week GE strike. GE's adamant and successful stand forced the union to finally take the company's 3% wage offer for 1960. The victory may well spark management resistance to union demands in the next two years.

First important 1961 negotiations come in the auto and farm machinery industries. Nationwide steel negotiations don't resume until 1962. But employers may now view GE as an object lesson: holding out against union demands in the face of and throughout a strike. GE's settlement, significantly, falls under the average 1960 contract settlement of 8 to 9 cents.

to cut costs when cutting metal...

You can't beat a

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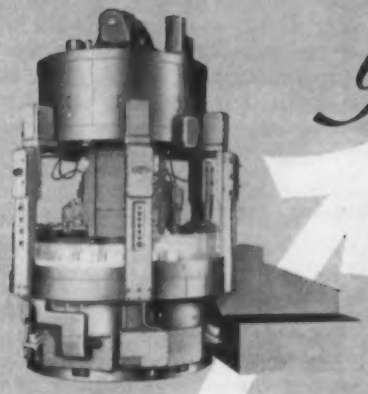

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10" with 6, 8, 12, or 18 spindles, 14" and 18" with 6 or 8 spindles.

Day in and day out — in metalworking plants around the world — modern machine tools designed and built by The Bullard Company are proving their ability to produce more in less time — thus, reducing the cost per piece.
It will pay you to investigate and compare the many advantages offered by modern Bullard machine tools.

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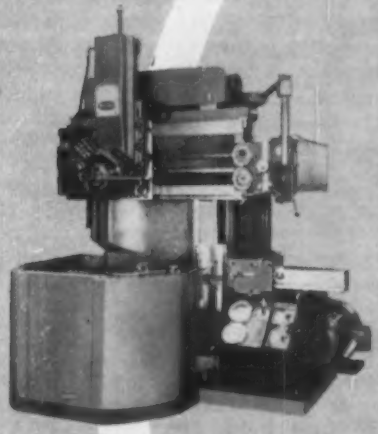
Ask About Our Leasing Or Time Sales Plans

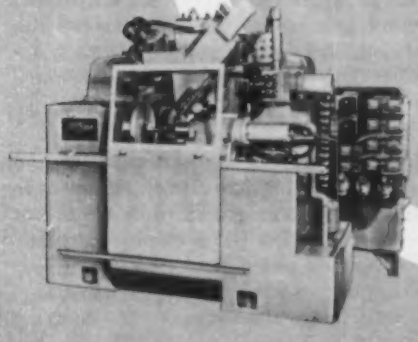


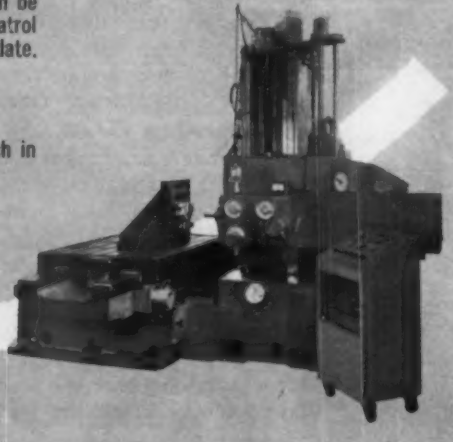
Dynatrol V.T.L. and Vertical Boring & Turning Mill
26" to 86" in 10" increments and 108", 124", and 144" table sizes.

Man-Au-Trol V.T.L. and Vertical Boring & Turning Mill
For fully automatic operation, can be applied to any or all heads of Dynatrol at time of ordering or at a later date.

Dynamill H.B.M.
In 3", 4" and 5" spindle size. Many combinations of bed length, table size and vertical travel.

Hydra-Feed Lathe
Automatic and tracer models each in four sizes.





DETROIT...

A bright forecast...

GM's normally reticent board chairman and chief executive officer, Frederic G Donner, chose the recent Motorama preview in New York to predict that new car demand in 1961 "may reach a level of 7 million units if consumer incomes continue to rise and consumer confidence is sustained."

Mr Donner backed his optimism by pledging a near record of $1¼ billion in tool and facilities for the coming year.

Of this sum, Mr Donner said that 75 to 80 per cent would be expended for domestic purposes. About 60 per cent of this total, he added, will be for facilities such as machinery, and equipment. The balance—$400 million—is for tooling of new models.

Dynamic obsolescence...

GM president, John F Gordon, used the same occasion to chastise "egg heads" who criticize the annual model change. "Automobile buyers," Gordon stated, "have benefited tremendously from the annual model change.

"The widely misunderstood pattern of dynamic obsolescence," he continued, "has spurred improvement of new cars, made millions of used cars available, and has provided better jobs for more people."

Later, under questioning by the automotive press, Gordon guessed that compact cars would be facelifted at about the same pace as has been past practice with standard-size cars. He justified the little change in the second round of existing compact cars, such as his company's Corvair, by stating that the market for these has not as yet been saturated.

"The annual model change spurs automotive advances," Mr Gordon claims, "because it keeps industry's designers and engineers close to the boiling point through the knowledge that if they do not perfect improvements promptly, they will lose ground to competitors who move faster."

The grand old men...

Those who have covered the auto beat for a while had the privilege, again at the recent New York Motorama, of hearing 85-year-old honorary GM chairman, Alfred P Sloan, Jr, make what is perhaps his last public speech. 800 invited luncheon guests—the cream of American industrialists—gave Mr Sloan a standing ovation before and after his remarks.

In his familiar Brooklynese he said: "My idea of an honorary chairman is someone who should be seen but not heard. An honorary chairman signifies too much of the past, and I am reminded of what our distinguished associate at General Motors, the late Charles F Kettering, used to say to us: 'We must look to the future, for there is where we expect to spend the balance of our lives.' "

However, Mr Sloan made a point for the present. In a bow to Mr Donner and other GM executives at the lunch, he noted that the administration of that company is no mean responsibility. "Here we have a business, currently running with a sales volume of over $13 billion, of which $2 billion is generated entirely outside of the United States. Of the $11 billion generated within the United States, half is returned to the American economy in the form of purchases of goods and services from over 27,000 suppliers." Mr Sloan was speaking without benefit of notes.

His conclusion: "I feel in a way that I owe you a certain amount of thanks for the attention that you have given (me) down through the years, and I now discharge that obligation, gentlemen, with many, many thanks for everything."

More about Motorama...

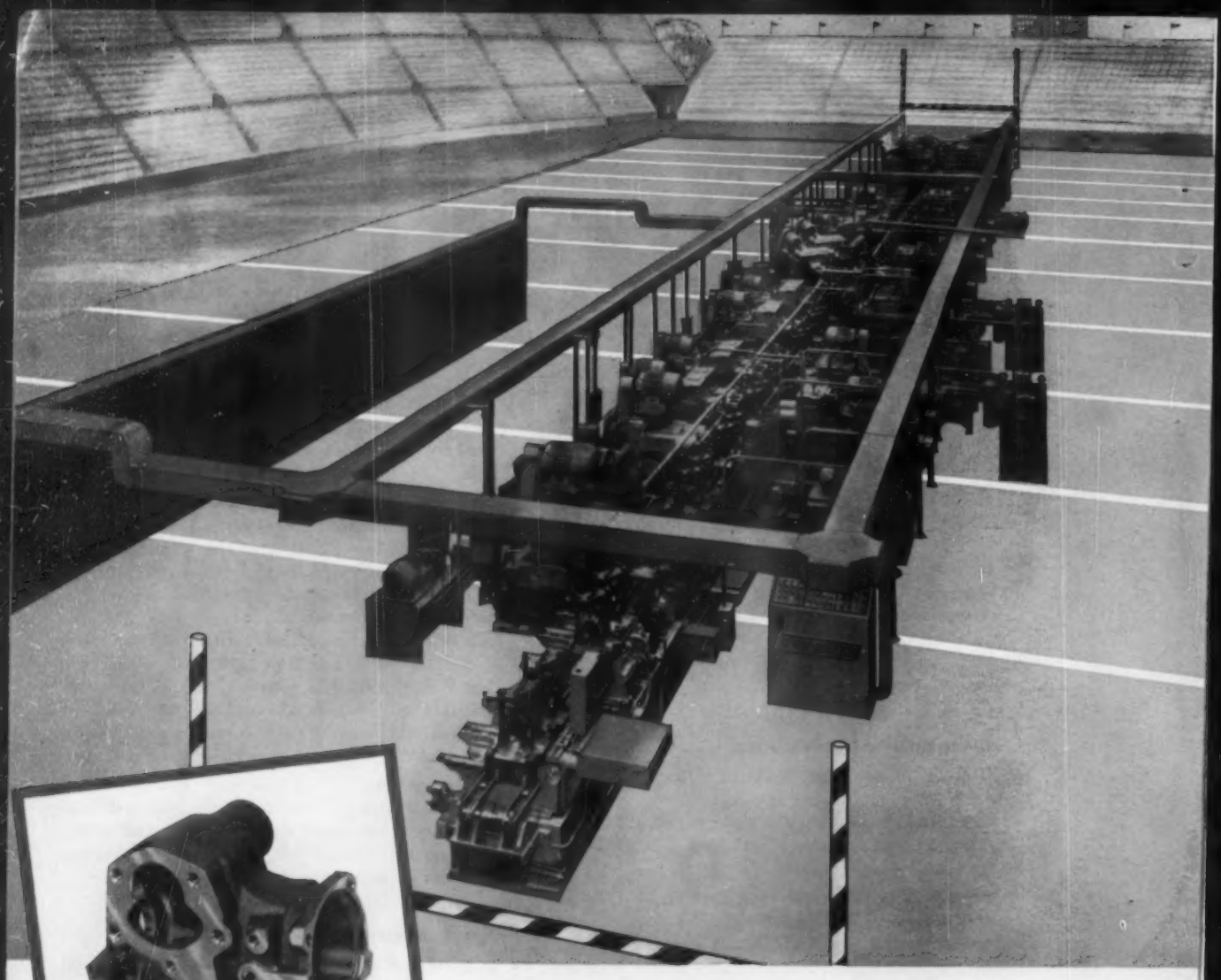
$9 million is a lot to gamble on an institutional program of any kind, yet that sum is a fair estimate of the cost to take Motorama to New York, Los Angeles and San Francisco. Here are some of the reasons for this cost:

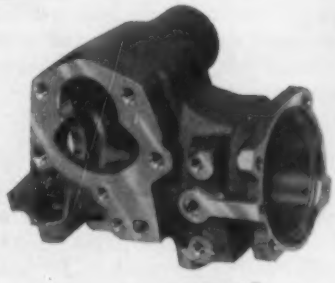
- 97 trucks and trailers are on the road for over three months.
- There are 31,000 square yards of custom-designed draperies and fabrics. Added to this are 82,000 lineal feet of electric cable, 52,000 board feet of lumber and 212,000 square feet of plywood.
- Feuehr and Martin, of "Can Can" and "Silk Stockings" fame, are Broadway producers who do not come cheap—nor does their crew of 50 singers and dancers who tour with Motorama.

Tailpiece..

While GM seems to be booming in every department except Euclid Div, Chrysler Corp is quietly writing off DeSoto. On December 15, the last of this marque will be built. Meanwhile, Chrysler sales executives are scurrying around the country signing up the hundred or so key DeSoto dealers for other Chrysler makes.

—Don MacDonald





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OPERATIONS:
8 - Milling
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40 - Drilling
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24 - Tapping
32 - Checking

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"MACHINES DESIGNED WITH THE FUTURE IN MIND"

300 FEET LONG . . .

completely set up and tested before shipment

Greenlee's manufacturing facilities have expanded to keep pace with customer requirements for mechanized production equipment. Complete transfer machines are production proven on our assembly floor before delivery. Test runs are made with coolant supplied from a central system built into the assembly floor. Actual production is simulated except that test run parts are subjected to 100% inspection . . . customer changes are made more readily and economically. This careful testing and thorough inspection pays off after installation . . . gets you into full production faster. Let a Greenlee representative give you the facts and figures.

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TRIM PRESSES • WOODWORKING MACHINES AND TOOLS • HYDRAULIC AND HAND TOOLS

GREENLEE BROS. & CO. 1928 MASON AVE. ROCKFORD, ILLINOIS

Ed: This looks good to me - let's discuss it - JB.

CIRCLE 242 READER SERVICE CARD

AIRCRAFT and MISSILES... TRENDS

New look for B-70...

The Administration has reversed itself on the Air Force's B-70 program, releasing $55 million extra to speed development of the Mach 3 manned bomber. Up to now, work has been limited to construction of one or two stripped-down prototype planes for flight tests. Except for some applied research on the bombing and navigation systems, all work on B-70 combat subsystems was halted in last year's economy drive.

The new decision means the resumption of weapon system development, the next big step before an order for large-scale production.

The additional funds bring the B-70 budget for the year to $265 million. The Air Force expects allotment of about double this sum next year to rush work on the new schedule for one XB-70 to test air vehicle and two YB-70 fully-equipped prototype aircraft.

Subcontracts to Motorola, for mission and traffic controls; Westinghouse, defensive subsystem; and North American Aviation's Autonetics Div, automatic flight controls—all terminated last year— will now be reinstated. NAA is weapon system contractor on the project. Air Force officials, however, caution that the development work will be resumed on an "austere basis."

Reasons for new decision...

Behind the new decision are these factors: political pressures generated in the presidential campaign; a new appreciation of the Air Force's argument on the strategic need for a manned bomber in the missile era; and a new realization that the B-70 will serve as a prototype for an American Mach 3 commercial airplane—something both the French and British are pushing.

Speedup on nuclear rocket...

NASA and AEC have invited bids from an industrial contractor to design and build a nuclear rocket engine. The action is interpreted as a policy to accelerate the project—dubbed "Rover"—by shifting development from government facilities at Los Alamos to a manufacturing contractor. The plan is to shift from a gaseous hydrogen reactor coolant to liquid hydrogen.

Larger solid-fuel space rockets...

NASA is also pushing ahead on development of large, solid-fuel-burning space rockets. The government space agency has picked three companies, Aerojet General, Grand Central Rocket, and Thiokol Chemical, to work up design studies on "supersize" solid-fuel rocket boosters. About $225,000 has been earmarked for the early work.

So far, all of our large rockets, including the Atlas and Titan, burn liquid fuel. The later missiles, such as Minuteman and the sub-launched Polaris, will use solid propellants.

Advantages of solid-propellant rockets over liquid-fueled rockets include higher reliability, simplicity, economy, and easier handling.

Under these study contracts, Grand Central Rocket will study and design a solid-fueled first stage for vehicles in the one-million-pound weight class. Thiokol will work on a first stage for a vehicle in the seven-million-pound class. Aerojet will design stages in both ranges. Booster thrust levels would be two to three times the vehicle weight.

These new investigations grew out of studies made last year by Lockheed and by Ford's Aeronautronic Division on the potential advantages of solid-fueled rockets. The new investigations will include details on cost, fabrication techniques, and methods for mating these first stages to upper stages. The three studies are to be carried on independently over a six-month period. Firms will coordinate their studies with NASA's Marshall Space Flight Center.

Tri-service plan for VTOL plane...

The Pentagon has set up a joint Army-Navy-Air Force program to develop a vertical take-off and landing aircraft. Design competition will begin as soon as the three services agree on specifications for the new aircraft.

Up to now, each of the services has had research projects of its own, involving some six companies, but restricted to test and evaluation.

AF plans radical space plane...

The Air Force is asking for $20 million in its fiscal 1962 budget for research and development on Space Plane, a manned, winged craft that would fly both in the atmosphere—storing oxygen to burn in its engines—and into space as far as the moon.

This radical plane would be the first manned space craft capable of propelling itself from earth into orbit and returning to earth under its own power.

The funds requested would cover studies designed to lead to flight tests in the 1966-68 period.

CIRCLE 242 READER SERVICE CARD

Get a production bonus with

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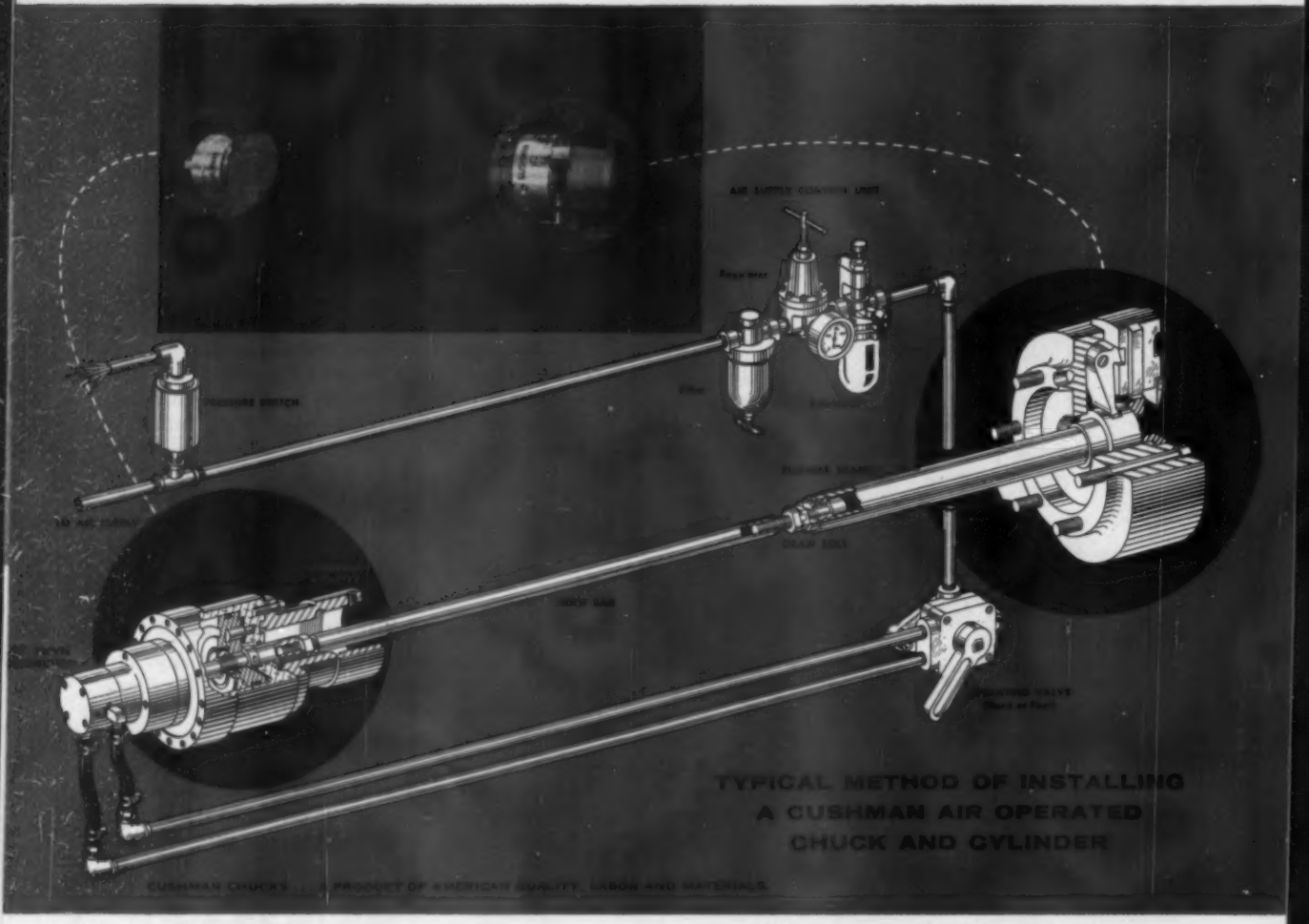
AIR OPERATED CHUCKING EQUIPMENT



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Yes, Cushman Air Operated Chucking Equipment automatically provides a bonus of increased production by eliminating operator fatigue—the principle cause of rejects . . . raising production rates with better accuracy and higher efficiency . . . decreasing floor-to-floor time. Safe, positive work piece grip permits accurate control of jaw pressure for the material being machined.

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MANUFACTURERS OF CUSHMAN POWER WRENCHES, MANUALLY OPERATED CHUCKS AND FACE PLATE JAWS

MACHINE TOOLS...

Ford's new tooling programs...

Ford is reported to have placed orders totalling around $17 million with two important press builders. This transaction is the largest in the press business in a long time and in dollar volume is almost equal to two months of bookings for the press industry at the average 1960 rate.

Ford's tooling program for its "compact compact" to compete with small cars like Volkswagen is currently a source of sizable orders for U S machine tool builders in their own plants here. The tooling for manufacture of the small engine and transmission is being awarded at Ford of Germany's Cologne plant, where these major components will be made and, according to reliable sources, shipped back to Dearborn for assembly. Tooling will be for 100 units per hour. The little car to be introduced in the 1962 model season beginning in the late summer of 1961, will be assembled in Cologne for world markets as well as in Dearborn for the U S market.

Fast delivery is a prime reason for U S builders getting the bulk of the Cologne tooling orders. Ford has set next April as the time when the machines for this tooling must be delivered. Few European builders can meet that delivery date because they have backlogs of one to two years. Reports are that the new production lines at Cologne are to be tooled for carbide at the insistence of Ford's U S headquarters staff.

Builders seeking orders in Moscow...

At least three prominent U S machine tool builders have top men on the way to, or already in, Moscow seeking orders for automated machines not on the forbidden list for shipment to iron-curtain countries. These companies are believed to have sounded out Washington informally about the granting of export licenses for shipment to Russia if they should get any orders. And they were given the green light.

Washington reports that a gradually growing number of U S builders are applying for export licenses.

Russian business is not easy to get. U S builders are competing against West European companies, for one thing.

European prices obviously are lower than American and that adds to the difficulties. U S builders with facilities abroad are in a position to take Russian orders to be produced there.

An export license for shipment of $5-$6 million of transfer machines to Russia was granted months ago to a U S builder. The application was made in anticipation of a possible order. Two U S builders have bid for this order, in fact.

Moscow has not yet placed this order. There is no assurance that it may not go to a Western European builder or to the German plant of a U S builder.

Should go to individual plants . . .

Concentrating on central agencies in Moscow is not enough. The plants where the new machines will be used should be visited and the top men sold. These men in turn will put in a request to Moscow for the machines they want.

Despite published stories that the U S is to ban all tape-controlled machine tools to the Red bloc, Washington is not contemplating any change in the policy that has been in force for many months.

Machine tools with closed-loop electronic units, and that includes most, but not all, numerically controlled machines, have long been on the banned list. Washington's policy has consistently been to forbid shipments of machines embodying technological advances which the Russians presumably do not have or have not perfected to the extent that we have.

N/C course for distributor salesmen

American Machine Tool Distributors Association is to put on a series of two-day courses throughout the country in the fundamentals of numerical control.

Tentative schedule of dates: Nov 14-15 at Olympic Hotel in Seattle; Nov 17-18 at La Salle Hotel in Chicago; Nov 28-29 at Kenmore Hotel in Boston; Nov 30-Dec 1 at Biltmore Hotel in New York City; Dec 2-3 at Hotel Syracuse in Syracuse; Dec 5-6 at Sheraton Hotel in Philadelphia; Dec 7-8 at Dinkler Plaza in Atlanta; Dec 9-10 at Adolphus Hotel in Dallas; Jan 9-10 at Sheraton-Gibson in Cincinnati; Jan 11-12 at Sheraton-Cleveland in Cleveland; and Jan 13-14 at Sheraton-Cadillac in Detroit.

Fee of $60 per man will cover, in addition to the instruction sessions, all the course material, two luncheons and a dinner. Course will be presented with top-level instruction. James C Kelley, AMTDA executive vice president, 1500 Massachusetts Ave N W, Washington 5, D C, can supply detailed information.

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MATERIALS...

Liquid hydrogen fuel...

In developing the propulsion system for the Atlas-Centaur, the free world's first high-energy space vehicle, Pratt & Whitney engineers have harnessed hydrogen. In its natural state, this tricky but highly potent rocket fuel is a gas which must be cooled to –423 F to become a liquid. Because liquid hydrogen offers a maximum amount of energy per pound, it becomes possible to lift, with a two-stage vehicle, payloads which would require three or more stages using earlier fuels.

One reason for the slow development of liquid hydrogen as a fuel has been inadequacy of liquid hydrogen supplies. Another reason is found in the problems of handling this cold and dangerous material. Since 1956, the US Air Force has put several large liquid hydrogen plants in operation. Recent years have also seen extensive research into better techniques for handling cryogenic materials—materials used or stored at extremely low temperatures.

Today, liquid oxygen and liquid nitrogen are fairly common, and their applications are growing rapidly. Another possibility on the horizon is wider storage of liquefied natural gas to supply peak winter demands. About 600 cu ft of gas can be stored as one cu ft of liquid. However, liquefied gas can be extremely dangerous. Much of the current research is aimed at assuring greater safety.

Cryogenic applications grow . . .

In an economy building around electronics, chemistry, and high-energy fuels, both low temperatures and liquefied gases are important—and are growing more important. Companies such as Westinghouse and Sperry Gyroscope are investigating the phenomena of electronic superconductivity which takes place as temperatures of conductors approach absolute zero. Oxygen is needed in large quantities by the steel companies. Fuel cells for electric power will require fuel gases in large quantities. The really big market in cryogenic equipment is still ahead —and metalworking will have to know which materials are best and how to work them.

Lower costs for low temperatures . . .

Pressure vessel codes should be revised to recognize the distinctive properties of 9%-nickel steel in cryogenic applications down to –320 F, according to U S Steel, International Nickel, and Chicago Bridge & Iron. These three companies cooperated recently in a series of tests to determine whether there are any significant advantages in the heat treatments recommended by the codes or whether a simpler treatment would produce acceptable containment vessels for liquefied industrial gases, including nitrogen.

Present codes now recommend that the 9%-nickel steel for such applications be double normalized and tempered and that the vessel be stress-relieved after fabrication. Tests conducted by the three companies indicate that the alloy will perform just as well. if not better, when it has been quenched and tempered instead of double normalized and tempered. Further, the as-welded vessels withstood impact and pressure tests just as well as their stress-relieved counterparts.

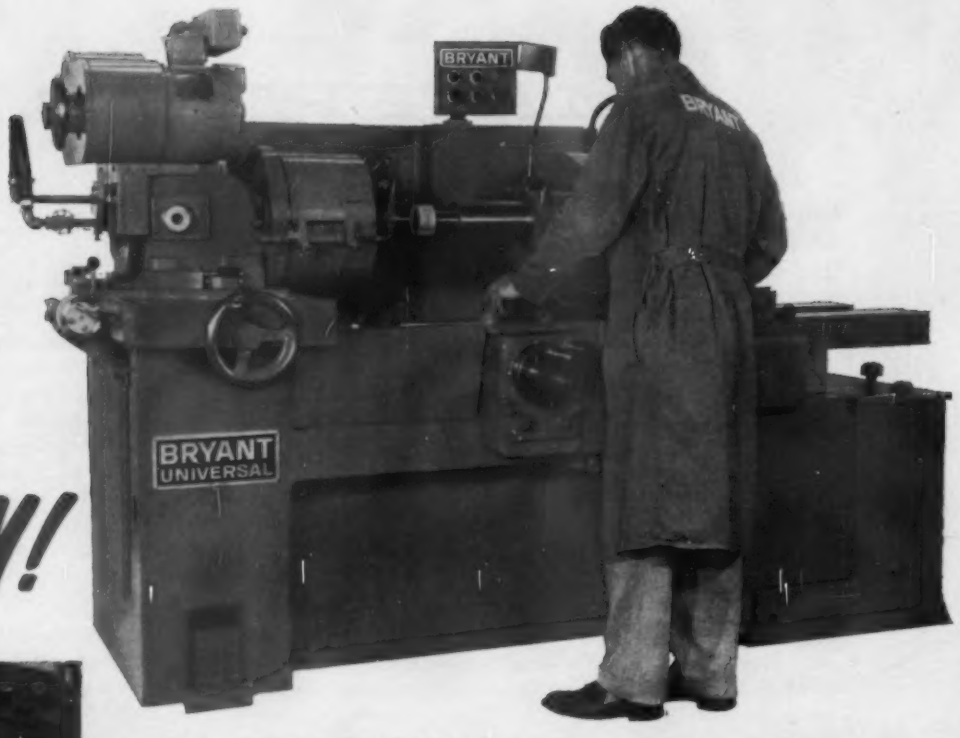
Where does this lead? Essentially, it leads to lower costs in the increasingly important field of processing, transporting, and storing liquefied gases at sub-zero temperatures. The 9%-nickel steel is not new in this field. Over 10 years ago it was developed specifically as a low-cost alloy for cryogenic applications. It costs 31½ to 33c per lb, compared with 55 to 60c for stainless. Comparing it with non-ferrous materials, U S Steel claims savings of 10% in final erected costs because of the alloy's good fabricating qualities.

However, the alloy carries a handicap—apparently unnecessary—in having to be stress-relieved after fabrication. If the code-writing bodies approve the change to quenching and tempering, and if they will accept as-welded vessels, costs will become even lower and will stimulate the work going on in cryogenic applications.

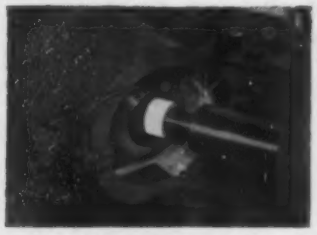
Plating alloys...

Recent discoveries in the field of electrochemistry promise major changes in conventional plating methods. Typically, engineers at Sifco Metachemical, Inc, a division of Steel Improvement and Forge Co, Cleveland, set up to exploit electrochemical techniques, have developed a "speed-plating" method which is 500 times as fast as tank plating and is said to eliminate hydrogen embrittlement. This company also has exclusive distribution rights in North America to the Dalic selective plating process.

Between the two techniques, or a combination of them, is seen "in-line" plating with equipment a part of the manufacturing line instead of in the plating room. One of the most significant developments to come out of Dalic recently is alloy plating. Solutions of two or three different metals are mixed as electrolyte and plated out of the mixture as an alloy.



NEW!



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For rotary ground flat surfaces!

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The BRYANT Universal Internal Grinder

A versatile machine that offers large machine capacity for internal, external and rotary face grinding.

The Bryant Universal performs a wide range of grinding operations and — what's more important — performs them quickly and economically.

The Bryant Universal is ideal for job shops or tool rooms where a single machine capable of handling a broad variety of workpart types and sizes is required. And it's accurate too: whether you are grinding to extremely close tolerances or doing routine production work, you'll find that the accuracy of size and finish obtained with the moderately priced Bryant Universal equals that of much higher priced machines.

Among the outstanding features of the Bryant Universal are:

COMPOUND CROSS SLIDE — Placement of the cross feed slide below the longitudinal traverse slide, results in sensitive, accurate slide control through reciprocation of a much lighter mass.

MULTIPLE WHEEL SPINDLE POSITIONS — Five longitudinal and two lateral positions for the wheel spindle combine with 15½″ of cross slide travel, eliminating the need for a large selection of grinding spindles.

SWIVELING WORKHEAD — 90° pivoting of the workhead facilitates the grinding of tapers or rotary face grinding.

LARGE WORK CAPACITY — The Bryant Universal swings 12″ dia. work within the chuck guard, up to 23″ with the guard removed.

REVERSIBLE VARIABLE SPEED WORK DRIVE — Variable speeds from 150 to 750 R.P.M. provide optimum grinding conditions for all jobs.

Contact your nearest Bryant or Ex-Cell-O sales representative, and let him show you how the Bryant Universal can make the production of varied workparts profitable for you.

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Internal Grinders • Special Machinery

WHAT'S AHEAD... in Metalworking

TRENDS

Slight upturn before end of year...

Metalworking production will pick up slightly during the fourth quarter, and the increase will be enough to make 1960 the best peacetime year ever for the industry.

Chances of a rise in steel production in 1960 grow dimmer. Orders from Detroit are nothing to shout about, and demand from the appliance and farm machinery markets continues weak. Steel men believe that industry is still cutting its inventories and will continue to do so through the rest of the year.

Automotive parts producers are operating at normal production schedules, but have been cutting back a little to eat up their inventories. No upswing in business is expected as long as the automakers continue to buy only for current production.

Bearing manufacturers report some increases in business but, in general, the outlook is soft. Backlog is fair, but the fourth quarter is not shaping up to be as good as was anticipated.

Business machine manufacturers are expecting a good year in 1960, an even better one in 1961. The most active segment of the business machine industry, the electronic data processing field, should pass the $1-billion-a-year mark by the end of 1960, and may go to somewhere between $2.5 and $5 billion by 1965, according to an industry spokesman.

Welding shops have had some new business, enough to keep them at normal schedules, but the outlook for the rest of the year is spotty. They're hoping that 1960 will compare favorably with 1959 but are making no predictions.

Commercial heat treaters are not optimistic. The expected upturn in the fourth quarter has yet to materialize. 1960 results may be down 20-25% from 1959, and the slowdown may hold through the early months of 1961.

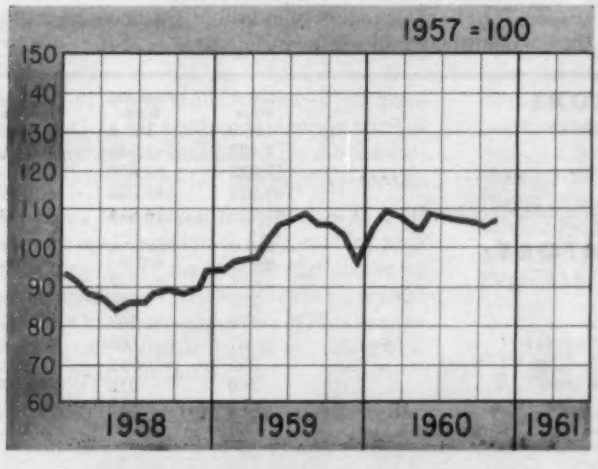
Railroad car business is static and the outlook for car orders is dim. "There are too many cars sitting around. Raw materials and finished goods aren't moving," says one spokesman. Sales have been down considerably for over a year for one major builder, and no upturn is expected.

Sales of resistance welding equipment are continuing at high levels. For the eighth consecutive month, shipments passed the $2 million mark, according to the Resistance Welder Manufacturers' Association. Shipments for the first nine months of 1960 were 16% ahead of 1959.

Tool and die business has turned upward in recent weeks, said John A Barth, outgoing president of the National Tool, Die & Precision Machining Association (new name of the organization), at the recent annual meeting. Such a pickup usually heralds an increase in plant expansion or retooling.

New orders for industrial heating equipment dropped 33% in the latest month. Orders for the first three quarters of the year totalled $62.5 million, a decline of about 14% from the corresponding period in 1959.

Home appliances present a spotty picture. Inventory is still high, but several lines are starting to sell at a brisk pace.



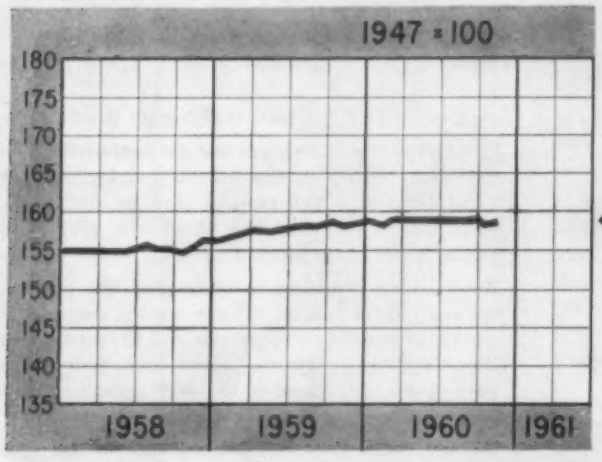
106

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	OCT Estimated	SEPT Preliminary	AUG Revised	SEPT Year Ago
Total Index	**106**	**105**	**106**	**105**
Machinery	100	103	104	
Electrical Machinery	113	113	113	
Autos	117	115	103	
Other Transportation	88	89	93	
Other Metalworking	108	111	108	

TRENDS WHAT'S AHEAD... in Business



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	OCT Estimated	SEPT Preliminary	AUG Revised	SEPT Year Ago
Total Index	**158.5**	**158.2**	**159.4**	**159.7**
Metalworking Machinery	**192.4**	**192.4**	**187.9**	
Other Machinery exc. Electrical	**173.1**	**172.8**	**171.5**	
Electrical Machinery	**159.3**	**159.4**	**162.5**	
Fabricated Metal Products	**145.2**	**147.6**	**148.8**	

Behind the dip in Gross National Product . . .

Although the announced dip in the gross national product (the overall measure of business activity) for the third quarter wasn't a cheering development, you shouldn't let it obscure the basic strength underlying the economy at this time. Thanks to this underlying vigor, any further declines in the GNP are certain to be mild and relatively short-lived.

The $2-billion dip that reduced the GNP rate to $503 billion was almost wholly the result of decisions to halt the inventory buildup that had helped spark business throughout the first half of 1960. In contrast with the previous three month period, when stocks grew at a $5 billion rate, stockpiling by business added little or nothing to the nation's total business volume in the third quarter. Spending in other areas of the economy didn't grow sufficiently to cover this gap.

Some additional cutbacks in business inventories are in prospect for the months ahead. And they are likely to cut a bit deeper into the gross national product.

Consumers, on the other hand, are spending at, or very near, record levels. And because their incomes are at record levels, there is little likelihood of any significant reduction in their outlays in the months ahead. They thus will form the foundation of continued high level business activity.

Moreover, consumers have stepped up their savings in recent months. The amount of income after taxes that goes unspent has risen considerably. And this may be an indication that consumers are building up their liquid assets to increase their buying on short notice.

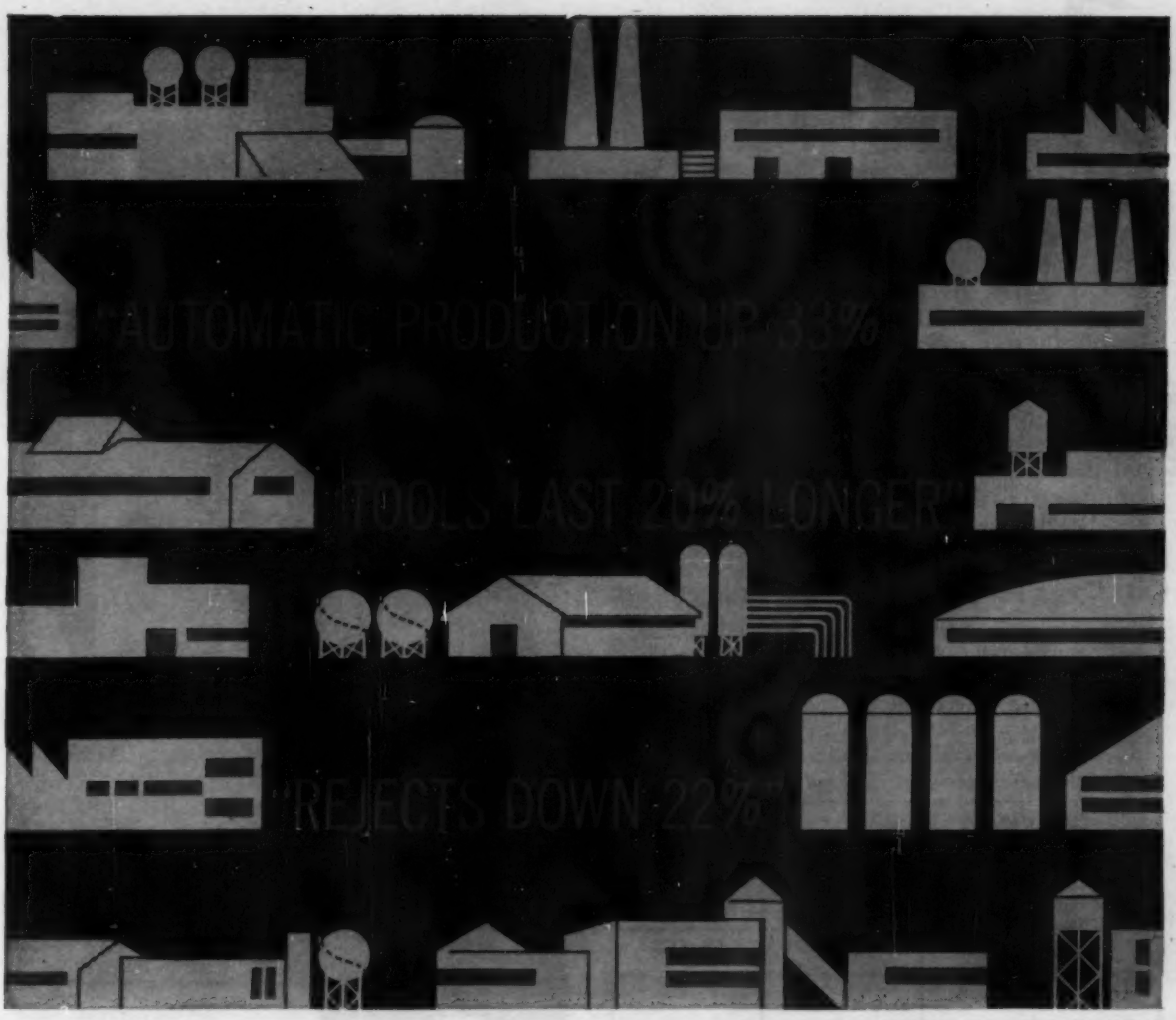
In addition, there are clear signs of stepped up spending by federal, state and local governments.

Consumer and government spending thus will be acting to limit and reverse and dip in the gross national product that might be brought on by cutbacks in business outlays.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	146.9	147.4	141.6
Steel ingot production (thousand tons)	1,473	1,545	368
Electric power output (million Kilowatt hours)	13,883	13,805	12,978
Production of automobiles	149,525	146,339	101,616
Engineering construction awards (Eng. News-Record, thousands)	65,256	74,814	47,639

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	291	309	378
Vacuum cleaners sales (thousands of units)	223	246	221
Washers sales (thousands of units)	175	207	318
Household electric ranges sales (thousands of units)	57	68	67
Radio production (thousands of units)	955	1,551	829
Television production (thousands of units)	269	518	350
Gear sales index (1947-49=100)	217.5	269.8	262.8
Foundry equipment new orders index (shipments, 1947-49=100)	80.0	164.8	110.7

*Seasonally adjusted



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These automatic screw machine users have found that tri-purpose Cleartex has ended the problem of cutting oil dilution.

Manufacturers have found that in 7 out of 10 automatics, lube oil leaks into the cutting oil sump in spite of the most careful lubricating techniques. This diluted cutting oil can cause shortened tool life and piled-up rejects.

New Texaco Cleartex has solved the problem forever for many manufacturers. They now use Cleartex for both cutting *and* lubricating, hence the leakage that occurs no longer dilutes the cutting oil quality. The exceptional chemical stability and load-carrying ability of the Cleartex series make them equally suitable for use as cutting oils, lubricants and even hydraulic fluids.

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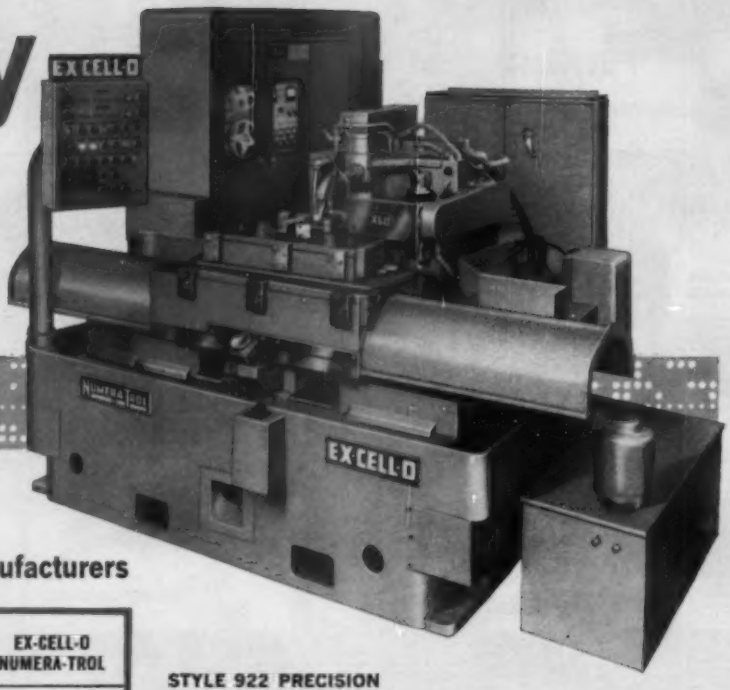

How Ex-Cell-O Numera-Trol Cuts Costs for Three Modern Manufacturers

Part: TEMPLETS	CONVENTIONAL METHODS	EX-CELL-O NUMERA-TROL
Lead time	128 hrs.	16 hrs.
Grinding per/piece	60 hrs.	6 hrs.
TIME SAVED	166 HOURS	

Part: FUEL CONTROL CAMS	CONVENTIONAL METHODS	EX-CELL-O NUMERA-TROL
Lead time	150 hrs.	40 hrs.
Machining per/piece	80 hrs.	7.5 hrs.
TIME SAVED	182.5 HOURS	

Part: STEAM TURBINE BUCKETS	CONVENTIONAL METHODS	EX-CELL-O NUMERA-TROL
Lead time	144 hrs.	24 hrs.
Machining per/piece	90 hrs.	12 hrs.
TIME SAVED	198 HOURS	

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Slides are controllable to .000025". Grinding unit is interchangeable with boring and turning unit.

PRECISION CAM-MILLING MACHINE
Slashes lead time in producing drum-type cams.

PRECISION PROFILING MACHINE
Performs intricate and accurate milling and grinding of 3-dimensional forms.

Are you faced with tough prototypes or production parts that "can't" be produced economically? See your Ex-Cell-O Representative, or write direct for details on how you can apply Ex-Cell-O's Numera-Trol system of tape-controlled precision machine tools to do more jobs, faster and more accurately!

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CIRCLE 247 READER SERVICE CARD

American Machinist / Metalworking Manufacturing ESTABLISHED 1877

Not Too Much But Too Little

New York subway union boss Mike Quill doesn't like the automatic subway train that the New York Transit Authority proposes to put on the Times Square-Grand Central shuttle run.

He calls the three-car manless train a "Coney Island gadget." He says loudly that the "TW will fight this kind of insane automation."

With refreshing frankness . . .

but appalling lack of understanding of today's world, he adds, "We don't care what kind of fancy box they put on the trains as long as they keep the motorman and conductor."

Other union leaders are just as disturbed as Mr Quill about automation, but take a more realistic attitude toward it. Officers of the International Association of Machinists are an example.

They view with alarm the technological breakthroughs typified by rapid development of numerical control and the reduction in manpower that it and other new production techniques make possible. They raise the spectre of widespread unemployment unless the work-week is lowered or demand for goods rises as rapidly as productivity increases (or preferably even faster).

To their credit . . .

they do not oppose automation. In fact, they agree that a moratorium on technological change is undesirable in the national interest. But since such change is inevitable, they advocate a collective bargaining program with management to cushion the impact of automation and to find other jobs for displaced workers.

This gets us down to a frank discussion of what the future holds. Technological break-throughs are occurring faster and faster for two good reasons. One is the sky-high cost of labor compared with any other nation. The greatest possible automation becomes a necessity if we are to compete at all in world markets and are to keep prices of goods at home within reasonable bounds.

The other is economic competition with Soviet Russia. Automation has become almost a form of worship in the Kremlin. The Russians are busy promoting and using it at every turn. For our own sake and the good of the free world, we cannot afford to halt even a moment in our hunt for every new, worthwhile technological development.

The United States already has become the first industrial nation in which, as the IAM points out, "the working class is no longer the major element in the labor force." White-collar workers outnumber the blue-collar. More people are employed in the service industries than in factories. As time goes on, the gap will widen. Metalworking, and every other industry, will be able to produce more and more goods with fewer and fewer men.

This may prove to be a disaster . . .

for industrial unions, at least so far as their total membership is concerned. But it cannot fairly be interpreted as a disaster for the nation.

To be sure, there will be painful shifts in employment as automation grows. Management has a serious responsibility to see that these shifts are made with a minimum of damage to individual and family situations.

But the growing needs and desires of the American people, including the industrial workers themselves, will create new jobs in the service industries and elsewhere to absorb the growing labor force.

What we are suffering from today is not too much mechanization but too little. American industry is falling short of taking full advantage of the technological changes available to it.

Only when the benefits of automation are more widely used will our national economy be as strong as it should be and will our potential enemies fully respect and fear our industrial strength in wartime and peacetime.

Burnham Finney EDITOR

6 precision spindles by Avey

The reliability of the Avey 250 Turret-Dex matches the quality of the thousands of Avey drilling, tapping, and production machines which preceded it. It is available as either an automatic machine or numerically-controlled with rotary or two-axis positioning table. Pre-selected speeds, feeds, rapid advance, and tapping cycles. Automatic depth control for all spindles.

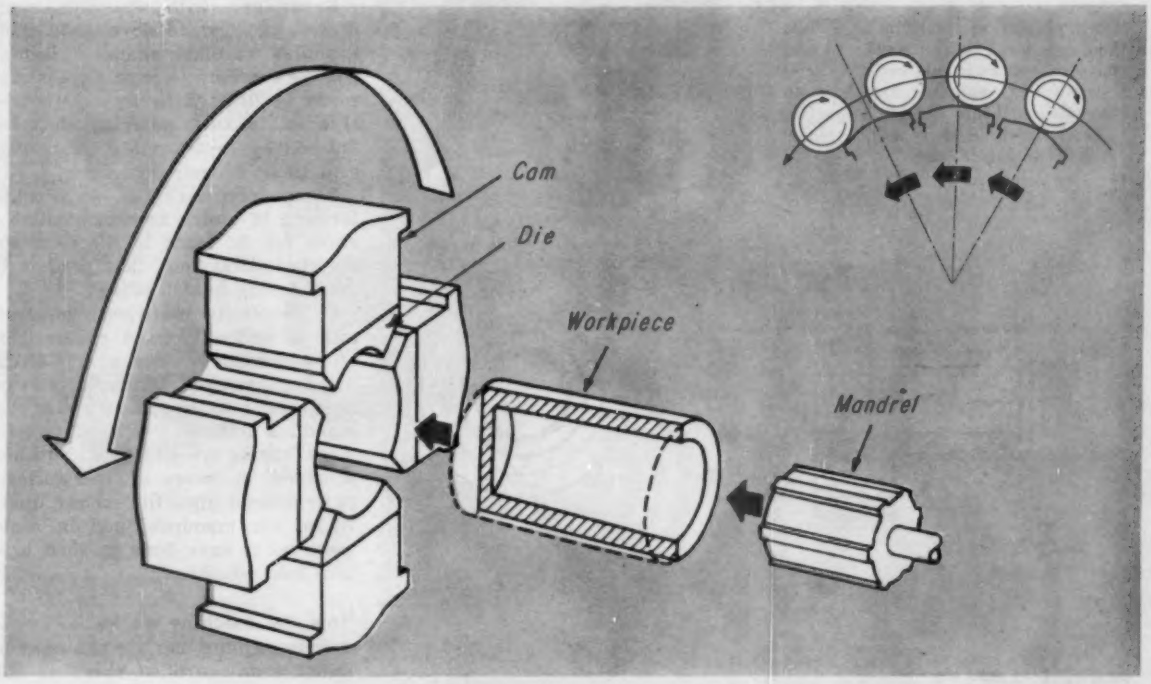
All spindles may be skip indexed. Automatic turret clamping. Positive spindle location. Rigid one-piece spindles, mounted in "O" precision taper roller bearings. Capacity up to 1¼" in steel.

The Avey Turret-Dex makes it more clear than ever that, for your drilling requirements, "Avey makes the right one for Avey makes them all." The Avey Division, Motch & Merryweather Machinery Co., Box 1264, Cincinnati 1, Ohio.

Avey

Write for catalog 460

Chrysler Intraforms clutch housing bores in one operation . . .



This is Intraforming, Cincinnati Milling's chipless machining process for forming profiles on the ID of cylindrical workpieces. Hollow cylindrical stock is placed over a mandrel and both are fed into a headstock to be squeezed by four rapidly pulsating forming dies (upper right) as they revolve around the OD of the workpiece. The cam-mounted dies pulsate as they contact hardened steel rollers located in a raceway in the machine's headstock. Work is squeezed 1500 times a minute

CHIPLESS MACHINING goes automatic

By Ben C Brosheer, Associate editor

Bore contours of starter motor clutch housings are now being finished to "impossible" tolerances in a single operation at Chrysler's newly retooled Indianapolis plant.

The job is being done quickly and inexpensively in what is believed to be the first automated application of Cincinnati Milling's new Intraform chipless machining process in the automotive industry.

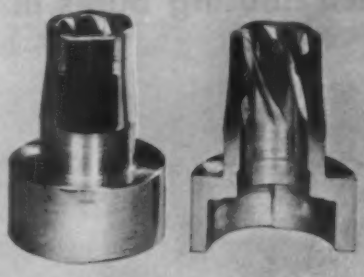
The clutch housings are already in use in the 1960 Chryslers and Imperials. The housings' bore profiles are cold-formed from fine-grain SAE 1018 steel screw machine blanks. The entire internal profile of the clutch housing is finished in one high-speed operation.

Conventional procedures would have required several internal broaching, grinding and polishing operations to machine the internal involute helical splines, the internal bearing seat, and four internal cam lobes (see illustrations).

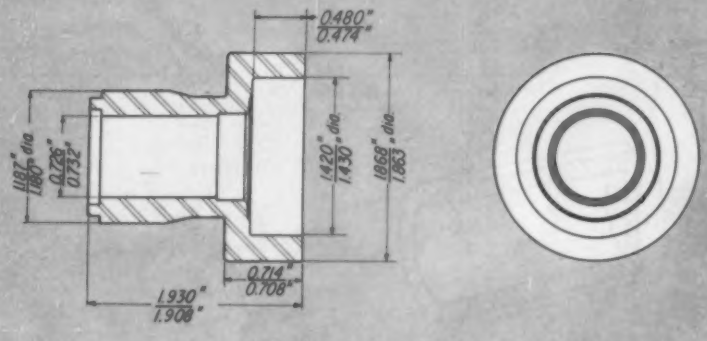
Chrysler's Model H-200 Cincinnati Intraform is driven at 220 rpm by a 40-hp motor, cold forming the clutch housings with the aid of simple and relatively inexpensive forming dies and mandrels. The rapidly pulsating dies squeeze the workpiece blank to the shape of the mandrel.

The Intraform (AM — Feb 9 '59, p 133) has approximately 200 tons of squeezing capacity, can cold form parts of ⅜ to 3 in. OD. Cast, forged, machined or extruded blanks can be cold-formed to very close dimensional tolerances, even where dimensional tolerances on blank diameters are as broad as ± 0.015 inches.

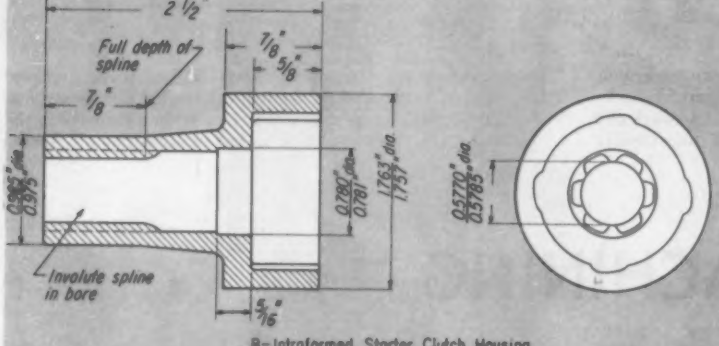
For this operation, surfaces of cast or forged blanks must be smooth, and should be pickled and/or shot-blasted to insure clean surfaces. Cold-extruded blanks should be an-



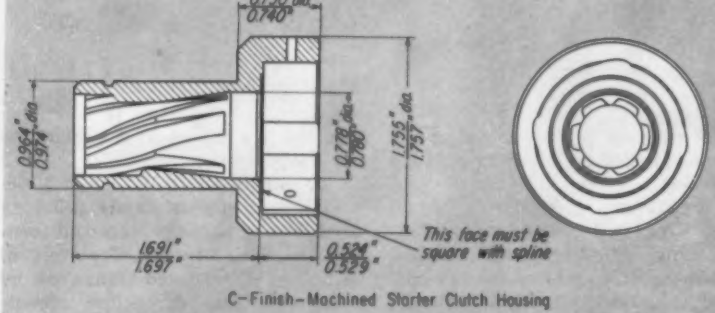
Bore profiles of overrunning clutch housings for Chrysler starter motors have six splines in one end, a central bearing seat, and four cam lobes in the other end—are quickly formed in a screw machine blank with a Model H-200 Cincinnati Intraform



A–Blank From Screw Machine



B–Intraformed Starter Clutch Housing



C–Finish–Machined Starter Clutch Housing

Starter clutch housings are produced from bar stock in three steps: (A) Blanks are machined from 2-in.-dia fine-grain SAE 1018 steel bars in an 8-spindle Conomatic, (B) Blanks are cold-formed internally in Intraform, and (C) OD and end surfaces are turned, grooved and faced in a series of Ex-Cell-O precision borers

nealed before Intraforming to minimize danger of bracking when working parts that have been severely deformed during cold extrusion.

Experience with the Intraform process has led to development of formulas for blank shapes, mandrel and die contours — so that parts can easily be finished to very close tolerances. In fact, external surfaces finished by Intraforming frequently require no further processing.

Where necessary (as with cold-forming of clutch housings), allowances can be made in the contours to offset distortions that later will arise during heat treating.

Concentricity between adjacent internal and/or external profiles can often be held as close as ± 0.00025 in., and internal contours conform very closely to the dimensions of the mandrels around which the workpiece blanks are squeezed. Finishes achieved in bores of Intraformed parts depend upon the surface quality of the mandrels, and in some cases bores have been finished to 6 to 8 micro-inches.

How the machine works

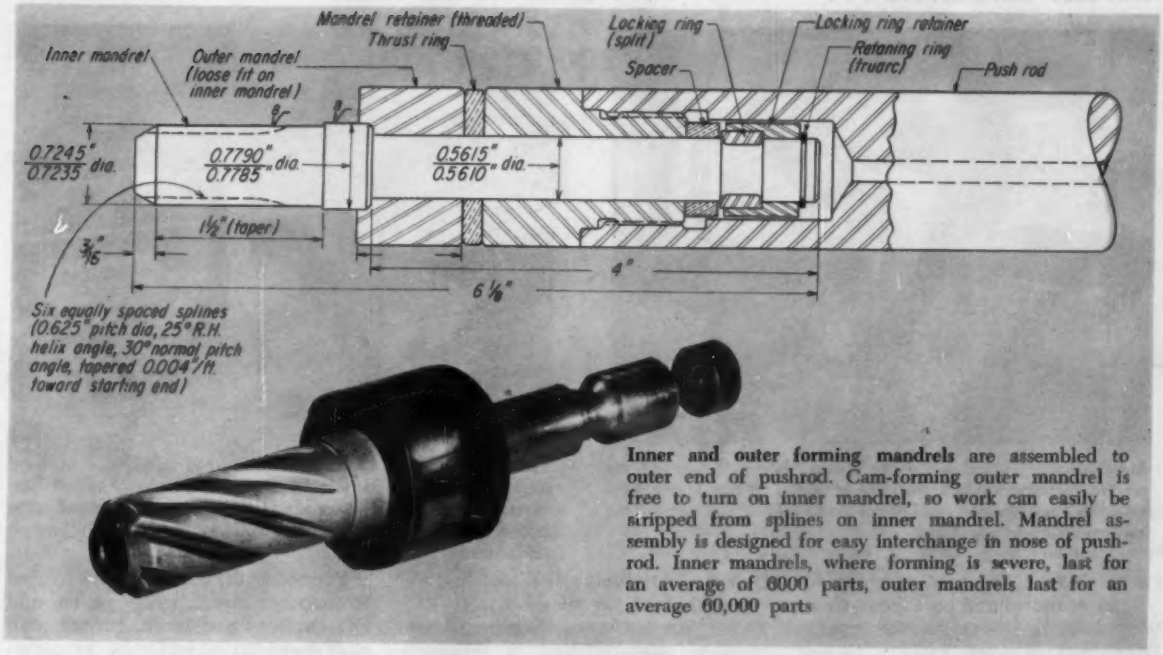
Four forming dies are mounted on radial cam-controlled slides in the Intraform's rotating head. As they contact a series of hardened steel rollers on the headstock, the slides pulsate rapidly while revolving around the workpiece's OD. Each pair of dies makes seven strokes per revolution. Because there is no hammering effect, there is little vibration, even though the work is squeezed more than 1500 times a minute.

Die inserts for the starter clutch housings are machined from a high-quality, water-hardening tool steel, and are hardened and drawn to Rh 61-63 C. **More than 200,000 parts have been Intraformed with one set of these dies, without sign of wear or surface breakdown.**

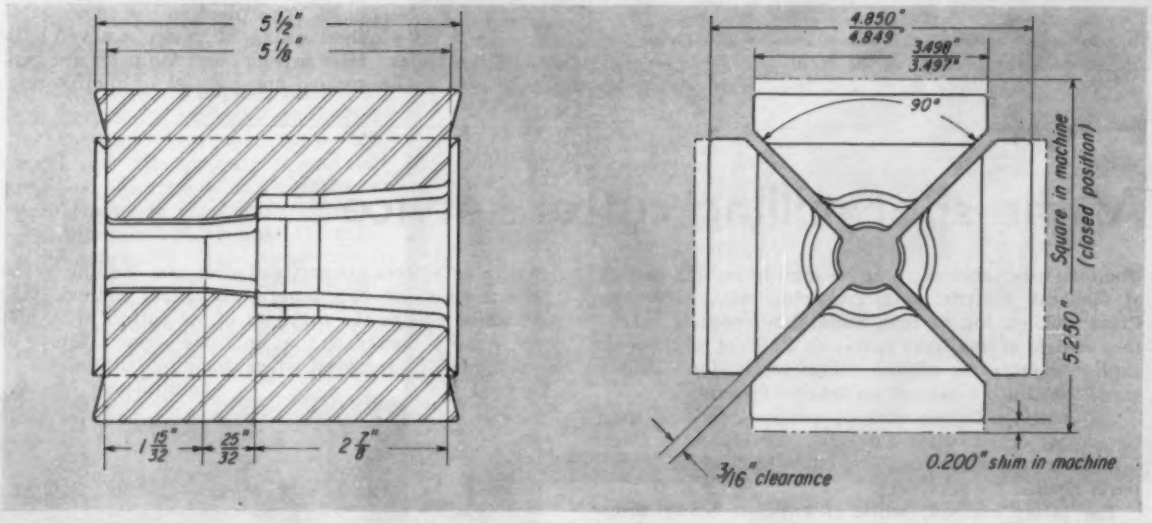
Because the internal profile of the starter clutch housing includes both helical involute spline grooves and straight axial cam lobes, the forming mandrel must be made in two sections (see sketch) so that it can be removed from the finish-formed workpieces.

The inner mandrel, which includes the splined extension and the spindle with which the mandrel is held in the forward end of the pushrod, is made from non-sulphurized SAE M2 high-speed steel and is hardened and double-drawn to Rh 58-59 C. Life is 6000 to 8000 workpieces.

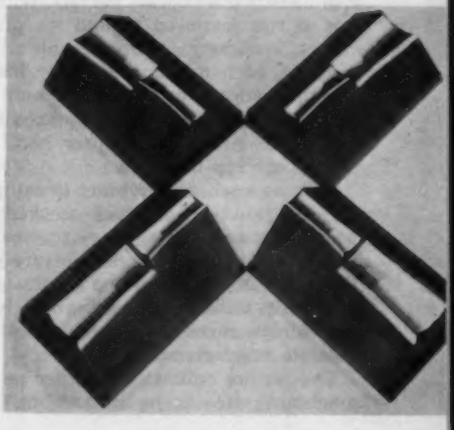
Outer (cam) portions of the man-



Inner and outer forming mandrels are assembled to outer end of pushrod. Cam-forming outer mandrel is free to turn on inner mandrel, so work can easily be stripped from splines on inner mandrel. Mandrel assembly is designed for easy interchange in nose of pushrod. Inner mandrels, where forming is severe, last for an average of 6000 parts, outer mandrels last for an average 60,000 parts



Four die sections — made from water-hardening tool steel, hardened and drawn to Rh 61-63 C — are mounted on Intraform's radial slides to squeeze steel blank into inner mandrel assembly. Photo (lower right): working faces of dies are polished smooth to increase wear life, last 200,000 parts without wear



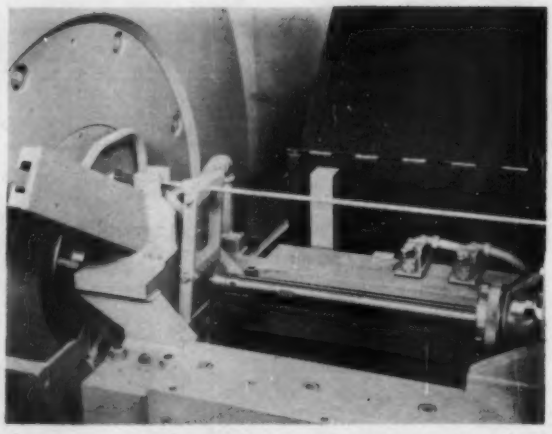
drels for starter clutch housings are bored to a slip fit on the inner mandrels, so that the finished workpieces can turn easily as they are stripped from the mandrel assembly. The cam portions of the mandrels are made from a medium-alloy, air-hardening tool steel (5.0% chromium and 1.0% molybdenum, like SAE A2) and are hardened and drawn to Rh 58-60 C. Life is about 60,000 workpieces.

The splined extension of the inner mandrel is tapered 0.004 inches per foot toward the outer end, while the periphery of the outer mandrel is tapered 0.71 inches per foot in the same direction — to facilitate stripping the work.

Machining cycle of the Intraform, which is equipped with automatic loading and unloading chutes and arranged for automatic cycling, is:

(1) Pushrod automatically advances to a positive stop, picking up

Automatically cycled Intraform finishes bores of housings to precise tolerances. Cold working of metal in blank increases hardness, and tensile strength of part, and at the same time improves fatigue resistance



Forming mandrels on end of Intraform machine's pushrod move blank from loading chute into radially pulsated dies in machine spindle, then drop the internally formed part into a discharge chute. Cycle is fully automatic.

a blank from the loading chute.

(2) Mandrel and part move slowly into forming position as the machine head rotates at 220 rpm.

(3) Mandrel and part feed into the dies, to a positive stop. As the dies form the workpiece to the shape of the mandrel, contact of the rotating dies causes the part and the mandrel to revolve at a speed slower than that of the dies.

(4) When the workpiece is finish-formed, the pushrod is retracted, stripping the formed workpiece into the discharge chute in passing.

(5) Cycle is automatically repeated — unless the machine is stopped by its operator.

Formed workpieces are delivered to another area, where ends and OD surfaces are faced, turned, and chamfered in a series of precision boring machines. Then four radial holes are drilled in the cam end of the housing, burrs are removed with wire brushes, and the parts are heat treated and cleaned by shotblasting.

At-the-spot milling cutter service

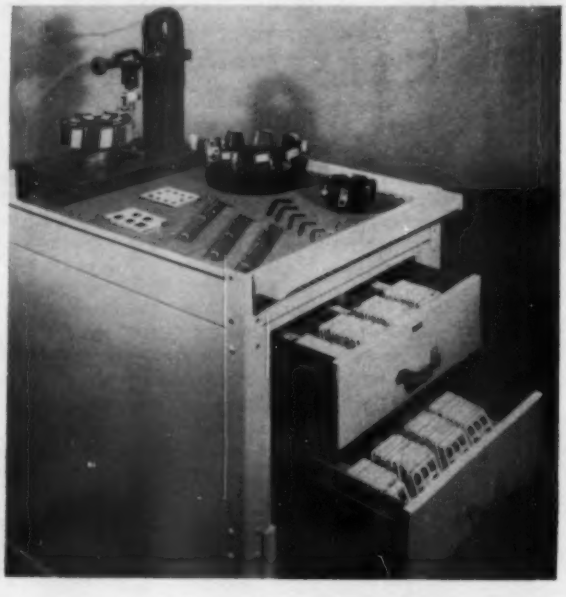
One man now services all disposable tip milling cutters at General Electric's big Pittsfield, Mass, Ordnance Plant and, on top of that, maintains complete inventory control of tips, body parts and all other tools necessary to service the cutters. The job is done with a small machinist's cabinet on wheels (photo).

Originally, GE's machine operators drew tips from the supply crib as needed or, alternatively, were given a number of sets of tips, screws, wrenches, and other parts needed for servicing.

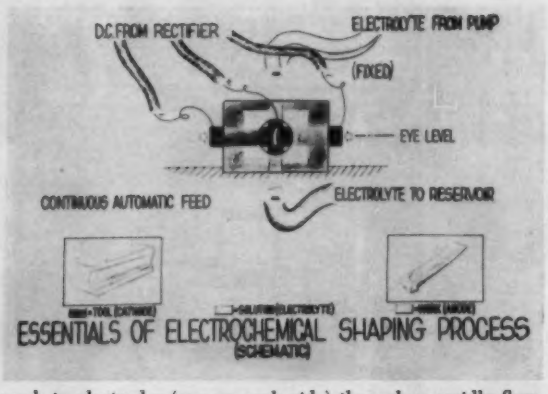
The latter method, while it entailed fewer time-consuming trips from machine to tool crib and back, also had its drawbacks, namely, with so many kits and sets of tips scattered around the plant at various machines, inventory control became a real problem. For instance, each machine operator had to stock at least two tip grades of carbide, three nose radius sizes, three nose chamfer sizes, and a complete set of torque wrenches. Allen keys, cutter body screws, pads and clamps or chip breakers.

GE's new wheeled cabinet is equipped with drawers divided into sections and stocked with tips, cutter body parts and all necessary service tools—plus torque wrenches of various sizes to insure proper pressure on the tips. Mounted on top of the cabinet (which incidentally serves as a work area) is an inspection fixture which checks the serviced cutters for runout or possible misalignment.

The service cabinet can either be used in the actual machining area or in the cutting tool grinding room, where all cutters are serviced after use. Adding to the effectiveness of this mobile servicing method, GE-Pittsfield equips the majority of its cutters with machine taper shanks, so that only one screw (instead of four) need be removed when changing cutters.



Precision forging firm develops electrochemical methods



Production electroshaping of precision turbine blades is done on "Sifco-Shape" machine, starting with a rough-forged blade. Special fixture, holding blade, is inserted into machine's plastic-walled shaping chamber. Electric current, passed from work to electrodes (one on each side) through a rapidly flowing chemical solution, removes the metal. Fundamental research has helped Sifco develop some other new techniques in rapid, tankless, electroplating

Critical problems in working the very hard, very tough, and frequently very heat-sensitive materials which are fundamental to space-age technology may be alleviated by a new electrolytic technique. The rate of metal removal appears limited to the metallic-ion exchange established by Faraday's Law more than 100 years ago: The quantity of material released at an anode or a cathode is proportional to the electric current. But this law can be applied much more efficiently than conventional tank processes have permitted so far. The big benefit is found in the knowledge that ion exchange is not determined by hardness or toughness.

Electrolytic cutoff of tungsten rod follows the same principles as electroshaping. Rapidly rotating ⅛-in.-thick stainless electrode wheel directs, by centrifugal force, a rapid flow of chemical solution between wheel and work. Multiple wheels can be used as current through solution cuts without contact between wheel and work. Cut is square and smooth

Broad possibilities

Scientists at Battelle Memorial Institute, Columbus, Ohio, under the direction of Dr Charles L Faust, learned that current densities could be tremendously amplified if the electrolyte was kept clean and in motion. The research is sponsored by the Steel Improvement and Forge Co, Cleveland, and all patent rights go to the sponsor. Originally, the project was sponsored to develop a better way to make forging dies for precision forging the difficult metals. However, the sponsor soon recognized that the process had broader metalworking possibilities.

By forcing a pressurized flow of electrolyte between the anode (work) and the cathode (tool) as a film only 0.002 to 0.003 in. thick, current densities of 1500 amp per sq in. permit removal of Waspalloy, tungsten, etc. at 0.05 to 0.1 ipm. Equipment has been developed for drilling, trepanning, contour shaping, and cutoff.

At present, the electrode for this work is stainless steel because the electrolyte is corrosive and will attack the tool when the current is off. Cathodic protection prevents attack on the tool during current flow. Because the tool is stainless, special forms such as turbine blades require considerable work to prepare. Until less expensive tool preparation is developed, the process is thought to be economically impractical for production quantities under 1000 pieces. This limit does not apply to tools for drilling, trepanning, and cutoff.

Company technicians will be made available to prospective users to review specific applications of the process and to design prototype units for pilot production of parts in Steel Improvement's own plants. Whether machines will subsequently be leased or sold outright with a license to use them will depend on future interest.

Stacked dies perform four operations per hit—drawing, blanking the window opening, forming the window opening, and cam flanging an oven door. Parallels *A* between upper member of die set and ram equalize heights of two sets of dies

Dies and molds go piggyback

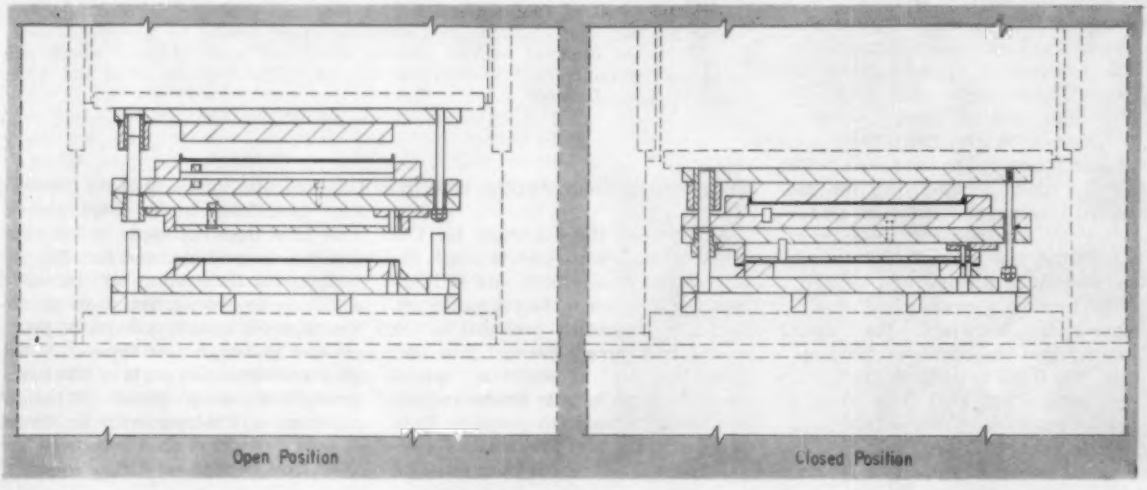
Why not stack dies one above the other in a press instead of side by side as is common practice? Not only can you boost the productivity of your existing presses, you might even be able to reduce the number of presses you need.

This piggyback technique, developed by W S DeMoss & Son, Inc, Indianapolis tool and die builder, can be used with a wide range of presses. Adequate stroke, not press size, is the criterion. If the press has adequate stroke you can stack single or even progressive dies.

Behind the whole idea is better utilization of the press stroke. The die requiring the least pressure completes its operation before the dies requiring greater pressure. In this way, a press can perform two or more operations in a single stroke; it can draw over the major portion of the stroke, trim or blank during the rest of the stroke. Naturally, if your job doesn't call for any secondary operations, you can have each die producing a different part.

Modifications may be desirable in the design of the dies. Whether they

HOW A PIGGYBACK DIE WORKS



are to be used separately or stacked, you can often save money by building the dies as a unit.

When die sets are stacked they are pinned together. To prevent cocking, no more than two sets should be stacked with separate guide pins. If more than two sets are to be stacked, make sure you use common guide pins and adequate guide bushings.

Feeding the press

Feeding is no problem when each die is turning out a different part. Be it a single or a multiple die, it can be fed by hand or with the feeder now on the press. DeMoss is now working on a mechanism to move parts from one level to another for secondary operations. Any scrap or slugs produced by piggyback dies can easily be fed out to the sides of the press in chutes.

Typical operations

Kenneth B Hiatt, president of DeMoss, points out two examples of how piggyback operation can cut time and costs:

- A mechanical press set up for stacked operation uses approximately 4 in. of its 16-in. stroke to draw a part. Very little additional stroke is needed to trim or blank. Thus, one press with two dies can perform two operations in a single stroke.
- An oven liner requiring five operations formerly was made on a line of five presses. With stacked dies, three presses now do the job.

The piggyback idea is also applicable to compression molds, and it offers the same advantages. In addition to the piggyback system, the DeMoss patent application also covers floating platens for existing equipment. Arrangements are being made to license the system.

Milan machine tool show reflects

Italy's metalworking boom

The Italian machine tool industry is growing in step with the country's current economic boom. Machine tool production in 1960 is expected to show a 40% gain over 1959, when 35,000 metric tons were produced. This growth, a result of increasing exports and domestic capital spending, is transforming the Italian machine tool industry from an art to an industrial science.

This transformation was evident at the recent Italian Machine Tool Exhibition in Milan. Held every two years, Milan's BI-MU (Biennale Italiana Macchine Utensili) is sponsored by the Italian Association of Machine Tool Manufacturers. This year's show presented about 4000 machines (85% of them Italian), drew a crowd of over 42,000 people, and did about $10 million worth of business. Fourteen countries exhibited at the show. The United States was represented by 15 firms.

Building blocks

Some of Italy's largest builders introduced machines built from standardized units. Maxnovo of Novara showed a series of lathes of standardized, interchangeable unit construction. Morando of Turin exhibited automatic screw-cutting lathes featuring interchangeable heads and standard bases. Minganti of Bologna also showed standardized machines.

Developments in metalforming equipment were shown by Mariani of Seregno, Galdabini of Varese, and Ficep of Milan.

Automatic control systems

In greater evidence this year was the use of automatic loading, feed and speed selection, servocontrols, positioning drums, servo-mechanisms and electro-magnetic and electro-hydraulic clutches.

Many large builders showed numerically controlled machines. In 1958, BI-MU's first year, only one numerical control system was exhibited, Maxnovo's copying lathe with Telephotomation punch card control.

In addition to Maxnovo this year, Olivetti showed a tape-controlled cam-milling machine that can cut cams up to a radius of 300 mm with an accuracy of ±0.02 mm. Caser of Pavia had a turret drill with a tape-controlled table-positioning system. San Rocco of Monza introduced a boring machine with a numerical programmer for coordinate measuring and positioning. Accuracy is ±5 microns (0.0002 in.).

Conventional relays have been replaced by static controls in many machines, especially in grinders, plano-millers, boring mills, and lathes.

Automatic in-cycle gaging

A whole new industry complementing the machine tool industry has developed in Italy since the last show. At that time only Marposs of Bologna showed automatic inspection equipment for in-cycle gaging. This year three firms exhibited such equipment, Marposs, Riv of Turin, and Nova of Novara.

Other machines

Minganti's automatic internal grinder grinds ring bearings at 150,000 rpm to a tolerance of 0.001 mm. Equipped for continuous-cycle operation, with automatic loading and unloading, and electronically controlled gaging equipment, this high-speed grinder can be installed in an in-line transfer setup.

Saimp of Padua introduced a combination hydro-electronic copying lathe with six automatic working cycles. Copying device and tailstock are hydraulically controlled; cycles are electronically actuated through pushbuttons. Saimp also showed a vertical miller with electronic plugboard control and centralized controls for feed preselection and speed selection.

Several American-designed machines were on display. Among them were the Besly DH4 double horizontal-spindle disk grinder, and Farrel's heavy-duty roll grinders and two-wheel swing-rest roll grinders, all manufactured under license by Giustina of Turin.

No automatic tool changers

None of the machines at Milan had automatic tool changers, nor did they represent anything revolutionary in metalworking technology. The accent here was on automatic control, automatic work handling, higher productivity, and speed.

Prospect for further growth

Prospects for further growth of the Italian machine tool industry are good. As one Italian builder put it, "If Italy were to make new investments or replacements amounting to only 10% of its estimated national peak of 700,000 metric tons of metalworking equipment, the Italian machine tool industry would have to double its present output."

By W K Brown, plant manager,
Continental Can Co, San Jose, Calif

Everyone freely admits that training is necessary. Any supervisor worthy of the name gives enthusiastic lip service to it. Yet the typical foreman's reaction is, "Sure, I'm for training my men, but how can I?"

Training changes things, and people do not quickly embrace change. It is abstract, because you may not get an immediate return on your training effort. Too, when you start practicing new techniques, they may not immediately function as smoothly as in the classroom.

More than any of these problems, though, training takes real effort and sacrifice of time, and it demands planning and scheduling. To attend courses, valuable men have to leave their jobs. This interferes with production schedules, overhaul programs, line speedups, and all the multitude of things that make a foreman's working day a busy one.

Another roadblock to effective training is that we often give the responsibility for training to people who are not equipped or qualified to train. Here's an illustration:

During the war, we hired women to do some men's jobs in our can-making plant. Our practice was to take an old timer and have him teach the newcomers how to operate a machine. At this time we hired one girl and put her on a body-making machine. When I made my rounds, I noticed that her knuckles were all cut and bleeding. She was picking up blanks with the wrong hand, and her knuckles were hit by the incoming blanks every time.

I told her she was doing the job all wrong and started to show her how to do it right. I'll always remember her reply: "You don't want to teach *me*. Your problem is with that knucklehead you've got going around teaching people to do it wrong, because I'm doing it just the way he showed me."

I checked, and that's the way my man was teaching it. I never did convince him to change his ways (he was left-handed), but I did change instructors and made sure the new one used the right method.

Another point about poor training programs: They are often too elaborate and try to cover too much ground. To be effective they must, in my opinion, be laid out in small increments. A trainee must learn each part, then practice until he is proficient, before he goes on.

Finally, I would like to stress one point that can never be ignored whenever we consider training: The *attitude* of your whole organization toward the whole program is the most important factor, bar none.

Budgeting for training

In the Continental Can Co. we start everything—including training—with a budget. The budget for my plant in 1960 is $6,400. Out of an average of 300 employees, we will train 84 people in various programs scheduled for this year. During the past ten years, incidentally, we have trained 417 people and have spent $43,000 on various programs. Of this total, $35,000 has been spent on hourly employees, $8,000 on salaried.

We back into our figures, actually, to obtain our budget needs. The responsibility for training is vested in the plant manager—myself—but the actual legwork is done by the industrial relations department. I delegate this responsibility, remaining primarily responsible for its effective attainment.

We keep records on every machine maintainer, and each man is scheduled through a formal classroom training program (for a specified number of hours) on each can-making machine. He also gets on-the-floor experience. Each foreman consults with the industrial relations dept to arrive at a rough draft of who needs what training next.

Certain of our trained employees are selected for instructor's training. Our budget includes funds for formal courses in instruction at an outside plant-instructor's institute. We also have instructor training in the plant, conducted by the industrial relations supervisor.

When an employee has completed his instructor's course, we put him on the budget as an instructor, then schedule classes for the slack part of the year. Then we calculate what these will cost.

We don't have "carte blanche" in our training budget. Guided by past experience, we estimate the amount of money we can spend. Every dollar must be justified, every need explained.

To increase the size of a department, or to start a new one, we would need to train more maintainers and perhaps a new supervisor. If

this happened, we would outline a program, substantiate it with what we want to accomplish, and explain why it is necessary. Then we *might* get the extra money.

Hourly-worker training

At our San Jose plant, a formal plant training committee decides on what training courses we will give. This group consists of the plant manager, assistant plant manager, manufacturing engineer, production-control supervisor, a foreman, and the industrial relations supervisor.

Here, briefly, are the types of training program that we give our hourly workers:

• **Machine maintainer programs**—These, already mentioned above, are offered in both press and assembly work, and consist of 50% classroom and 50% on-the-floor training. Under an instructor's guidance, trainees study and practice on one machine part each day.

• **Lift-truck driver program**—Taught by the assistant foreman of shipping, this course covers 24 hours of training.

• **Quality-control training** — Subjects covered here include basic inspection training, basic mechanics (learning how our equipment works), press inspection, and shipping inspection.

Supervisory training

Besides the courses for hourly employees, Continental Can Co provides courses for its supervisors, under the general title, "How to Plan Your Job." These help supervisors in their personal planning, also explain the functions of our staff departments.

In these supervisory training courses, we stress the following:

• **The company's annual report.** We think it is valuable for all supervision, as businessmen, to be able to read the report and to understand our company's financial position.

• **Communications**—Certainly one of the most important management tools, communications need to be stressed. We teach communications up—and down—and try to give the supervisor an understanding of the psychological barriers to communications in human relationships.

• **Conference leadership**—This is a follow-up to communications instruction, worked out with the University of Chicago over a period of years. It is an invaluable technique for those who conduct staff and foremen meetings.

• **Problem solving**—Here is another off-shoot of communications training, given only to potential plant managers and assistant managers.

• **Foremanship**—At the San Jose plant, I felt that our foremen and staff heads needed further polishing and education in some subjects. To devise a training course that would give them a feeling of accomplishment and of increased status, we consulted the University of Santa Clara. The result was a foremanship course, taught by college lecturers, that covers the following subjects: planning and organizing . . . human relationships . . . oral and written expression . . . costs and their control . . . economics . . . government and business . . . union-management relations.

At the end of this 32-week course (trainees meet for a two-hour period once a week), we award a certificate of foremanship. I think this course has been a really important factor in the development of our team.

Other courses

We have a pre-supervisory training program, conducted after working hours by myself and members of my staff, for employees who voluntarily come (without pay) to learn. In this program, we discover those employees who have enough interest in administration to donate time for their own improvement.

In this course, we cover the following subjects: our company . . . management principles and functions . . . the supervisor's job . . . using staff services . . . company policies and rules . . . employee-benefit plans . . . safety and health services . . . labor-relations philosophy . . . controlling quality . . . production, inventory, and maintenance . . . training and job instruction . . . human relations . . . handling complaints . . . maintaining discipline . . problem cases . . . profit planning.

Lastly, we have a management trainee program. We recruit college graduates and also select people with outstanding ability from our own ranks. These trainees are put through a concentrated course that covers all departments in twelve months, with each trainee spending six months in his specialty. This course is conducted by division and is not really administered by the plant.

Attitude to training

In any training program, it is really important to set the stage, to find out how much your man already knows, and to approach the subject accordingly. To illustrate this point, I will relate an experience I had some years ago.

I had told my chief inspector to teach every inspector on the assembly floor how to make a tin-content test on silver solder. Here's why: If the tin content got above a certain percentage, the mush range lengthened and the solder did not set properly, causing leaks. To stay out of trouble, we made this test often.

Although I kept after the chief inspector, he finally confessed one day that he was unable to teach one of his men how to make the test. I promptly said, "Give me your job breakdown and I'll teach him myself."

After showing the man how to take specimens from the solder pots, I took him into the lab and went through the entire test routine, one step at a time, following the old theory "Tell him, show him, have him tell you, and let him do it."

Now I said, "Okay, Paul, now you take the weights you have obtained, subtract one from the other, and divide by this factor."

He replied, "But I can't."

"Why?" I asked.

"I only went to third grade. I can't do arithmetic."

At this point I realized that I had done everything wrong. I had had no confidence in my chief inspector. I hadn't found out anything about the man I wanted to train. I hadn't given him a chance to tell me anything, either. And I had assumed that anybody can do subtraction and long division. So I had plowed right into the training with a job breakdown, a routine that had worked with everybody else. Not this fellow.

We are a long way from the time when the boss took a new man to the job, stared at him until he looked away, and then spat on the floor as an introduction to the job. But we still have a long way to go. No study or science has ever been sufficient unto itself—least of all training.

If there is any key to a successful training program, it is that the attitude of your whole organization must be in favor of training. Everyone must recognize that training requires effort, patience, and discipline. The manager must insist that the program go as scheduled, just as a production line must.

This is the key. The head man has to put all his weight behind the program and not let anything interfere with it. To improve the skills of his people is one of his biggest responsibilities. In this area he can do himself more good than in any other I know. We have to be smart enough to do things today that will pay off in the future.

(Adapted from a talk to the Northern California Chapter of the American Society of Training Directors)

NEW NMTBA PRESIDENT
Everett M Hicks
Vice president & general manager
Machine Tool Division
Norton Co, Worcester, Mass

FIRST VICE PRESIDENT
Francis J Trecker
President
Kearney & Trecker Corp
Milwaukee, Wisc

SECOND VICE PRESIDENT
Wallace E Carroll
President
American Gage and Machine Co
Chicago, Ill

Machine tool sales:

Fourth quarter outlook brightens

The fourth quarter should be the best quarter in new orders that the machine tool industry has had in a long time, Alan C Mattison, president, Mattison Machine Works, predicted in his presidential message at the 59th Annual Meeting if the National Machine Tool Builders' Association at The Homestead, Hot Springs, Virginia, November 2-4. His forecast was based on reports from builders who exhibited at the Machine Tool Exposition in Chicago last September.

Beneficial effects of the Exposition will be felt through 1961 and well into the next two years, in Mr Mattison's judgement. He revealed that 60,000 visitors, comprised mostly of engineers, production experts, factory managers, product designers and financial men, attended the Exposition. A large share of them came with authorization to select machines for modernization programs.

Though industry in general has been doing a tremendous volume of business, Mr Mattison said that the troubel is that once again profitless prosperity is back. Manufacturing costs have been too high and foreign products, with lower costs, are cutting into domestic markets. Sooner or later U S manufacturers will realize that costs must be reduced and that machine tool builders have what it takes to fulfill the need.

Foreign competition—double threat

While foreign competition is a threat to the machine tool industry, it is an even greater threat to many industries that are machine tool customers, Mr Mattison pointed out. This threat may well spur them into modernization programs.

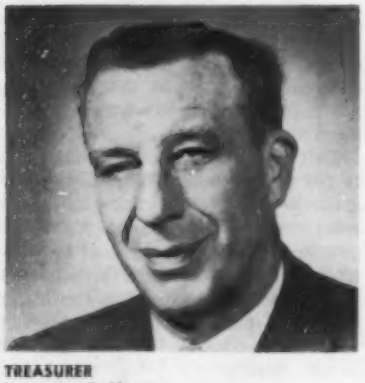
It is true that machine tool imports into this country have been increasing, Mr Mattison acknowledged, but "During 1960 exports have increased much more rapidly than imports and in larger volume." U S builders are making machines wanted abroad. In addition many builders are manufacturing abroad while they can compete in foreign markets with costs comparable to those of foreign builders.

Mr Mattison declared that the job ahead of the machine tool industry is clear—to continue to out-design competition whether domestic or foreign.

"It's not enough just to design for an exposition every five years." We should keep at it all the time, if we can make sure that we always lead the world in ability to increase productivity, we can look forward with assurance to the years ahead."

Standardization proposals

A report on the standardization proposals of a group of machine tool users (*AM/MM* — May 16 '60, p99) was made by Walter K Bailey, president, The Warner & Swasey Co. The advisory group that has been formed to represent machine tool builders and the users' group has held several meetings and has met with the com-



TREASURER
Lawrence C Gleason
President & general manager
Gleason Works
Rochester, NY

NEW DIRECTOR
Bruce F Olson
President
Sundstrand Corp
Rockford, Ill

mittee formed to study milling machines. Similar committees will be formed for other types of machines and meeting dates set.

Soviet machine tool output

Soviet seven-year plan (1959-1965) goals call for production of 200,000 metal-cutting and 36,200 metal-forming machine tools a year by 1965, Forrest D Hockersmith, Director of Export Policy Staff, Office of Secretary of Commerce, Washington, revealed. Around 1500 different types and sizes of metal cutting machines will then be manufactured, included 50 types of numerically controlled machines. Some 1300 automatic lines are to be installed in Soviet metalworking plants.

In addition to new machine tool production in the seven-year period, the Soviets expect to modernize 500,000 existing machine tools. By 1965 the machine tool inventory in Russia should be 2.5 million units compared with 2 million now.

Mr Hockersmith believes that the Soviets will achieve the major part of their program because of the high degree of standardization in their machine tool industry, specialization of production in many plants, use of conveyor methods of machining and assembly, and the extensive research facilities available. Their machine tool modernization goals are likely to be surpassed. They probably will be able to attain their goal of 1300 automatic production lines only by importing some lines to supplement their own output.

Russia today is building machine tools in 170 plants, 50 of which specialize in metal cutting and 10 in metal forming. The remaining 110 plants produce other machinery in addition to machine tools. Soviet machine tool industry employs more than 125,000 workers. About 30% of Russia's machine tool output this year will consist of lathes, 25% drilling machines, 10% milling machines, and 8% grinders.

About 4000 heavy machines weighing over 10 tons each will be built, according to Mr Hockersmith. Another 4000 will be classed as automatics and semi-automatics. Among large machines produced by Russia are lathes for 10 ft dia and 90 ft long parts, gear hobbers for up to 20-ft dia gears, vertical boring mills of 70-ft. dia capacity and roll grinders of 80-in. dia capacity. Current emphasis is on increasing the proportion of the smaller size machines especially precision types such as lathes similar to Monarch 10EE, precision drilling machines, and fine pitch precision hobbers.

Soviets have built many prototypes of numerically controlled machines since 1958 including lathes, milling machines, drilling machines, horizontal and vertical boring mills and jig borers, Mr Hockersmith said. Functions performed are automatic positioning and 2- and 3-dimensional duplicating. This year about 400 electrical discharge and ultrasonic machining units will be built compared with 200 last year and 95 in 1958. All machine tool research facilities in Russia are being devoted to programming controls and electrospark and ultrasonic machining.

The majority of metal forming machines built in Russia are general-purpose presses (mostly mechanical), hammers, shears, and bending machines. More sophisticated types such as spin-forming, stretch wrap forming, and others are just emerging from the prototype stage, Mr. Hockersmith declared. Nevertheless Russia has built up considerable capacity for making large forming machine tools.

By 1965 Russia expects to have so much machine tool building capacity that it can export 30,000 to 40,000 units a year, but Mr Hockersmith believes that competition from the West, China, and other communist block countries will be so great that it will not be able to attain that goal without deliberate dumping.

Quality of Soviet machine tools judged by Western standards runs the gamut in technological advancement and craftsmanship from obsolete to highly advanced types, and from poor to very good in workmanship, Mr Hockersmith said. Materials are good and design is functionally adequate. Almost all models, however, are underpowered compared with similar sized U S machines.

Bevel gears rated by pitting resistance

Final agreement on the gear classification manual and presentation of a new method of rating bevel and hypoid gears were among the highlights of the fall meeting of the American Gear Manufacturers Association, held in Chicago, Oct 23 to 26.

The new classification manual (*AM*—Nov 16 '59, p134) will establish 14 classes of gears (Class 3 through Class 16) to replace the present four commercial classes and three precision classes.

Printing of the new manual will now be rushed and copies are expected by the end of December.

In the past, the method for rating the surface capacity of bevel and hypoid gear teeth was one using an empirical formula based on field experience. For most gears this formula has been conservative, but below 10 dp it has not always been applicable.

The formula stated that the allowable load in pounds per inch of face width for case-hardened gears was 470 times the square root of the pinion pitch diameter in inches. A modifying velocity factor was generally introduced in order to eliminate the danger of scoring.

Work has been in progress at the Gleason Works for a number of years to develop separate pitting and scoring formulas. Wells Coleman of Gleason reported on the new pitting formula. The formula provides a method for calculating the surface compressive stress at the most critical point. The new method will provide a method of comparing various designs of bevel and hypoid gears and estimating their life. This, in turn, will permit selection of gears to closer limits.

Mr Coleman's analysis is available in AGMA report 229.05. In brief, it takes into account these points:

1. The compressive stress is calculated at or very near to the point at which it will be a maximum.

2. The position of the point of load application is determined by taking into account not only the theoretical lines of contact but also mismatch and certain experimenal evidence.

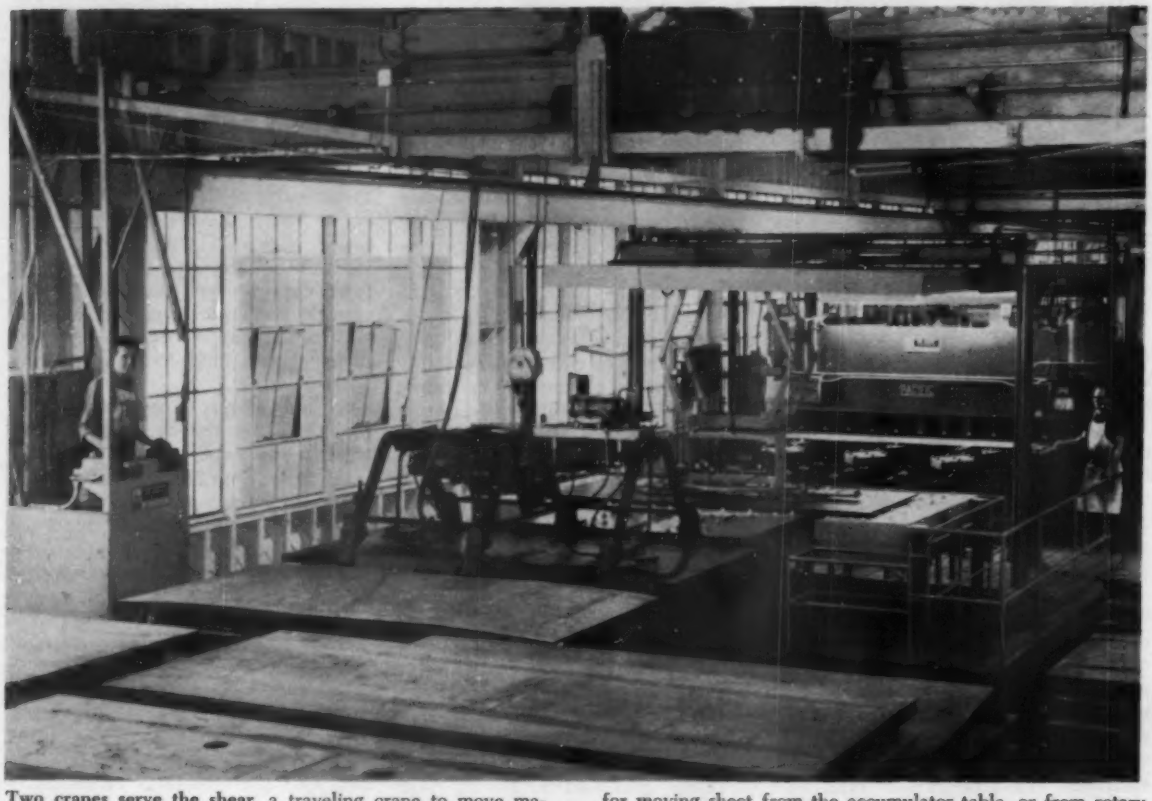
3. The amount of load carried by one tooth is estimated in a rational manner based on tooth bearing modification and contact ratio.

4. A load distribution factor which allows for the deflection of the gear mountings is included.

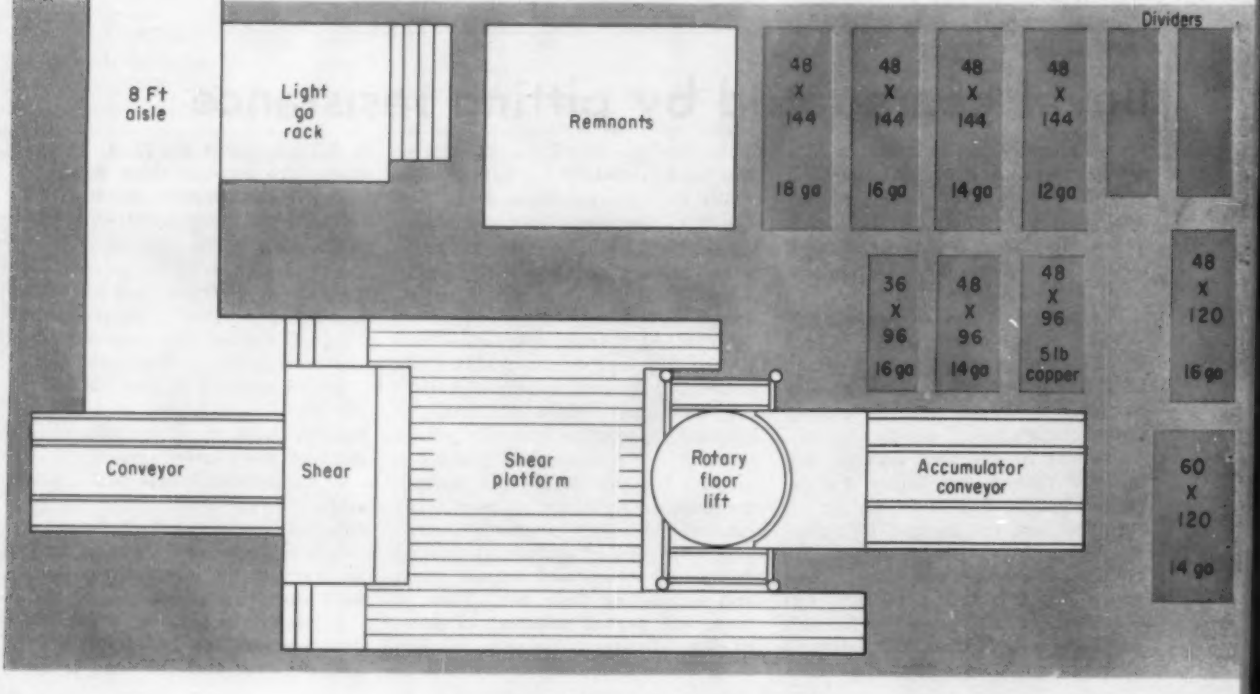
5. A dynamic factor allows for the accuracy of the gears in relation to their operating speed.

6. An overload factor which takes into account the character of the prime mover and the load is used.

Shear output tripled by



Two cranes serve the shear, a traveling crane to move material from stockpiles and a smaller one with vacuum lifters for moving sheet from the accumulator table, or from rotary table, to the shear table



sheet-handling system

Shears often operate less than 1% of the time! Time studies reveal that almost the entire working effort in a shearing department is frequently spent on:

- Selecting, transporting, laying out and measuring sheet and plate.
- Moving and positioning material at the shear.
- Picking up and stacking finished pieces.

Under the most favorable circumstance—when light-gage strip is on hand at the machine—many shears operate less than 50% of the time. If production volume warrants, the shear may be cycled at a constant number of strokes per minute, but the operator can catch no more than every other stroke.

These twin problems of slow material handling and wasted shearing strokes have been solved by engineers at the Food Machinery & Chemical Corp, Riverside, Calif. They conceived a unitized layout for a shearing department and installed a high-speed handling system for transporting sheets and plates from stockpiles to and through the shear. Now instead of a three-shear, five-man operation, they have a one-shear, two-man setup.

Food Machinery's system can be applied on a unit basis in any fabricating plant or warehouse, it is said. Mechanized sheet handling is a necessity for ¾-in. shears and larger, and shears of 16-ft length or longer. The system can be used profitably for cutting light plate and sheet in plants which would normally require two or more conventional shears.

Straight-line flow

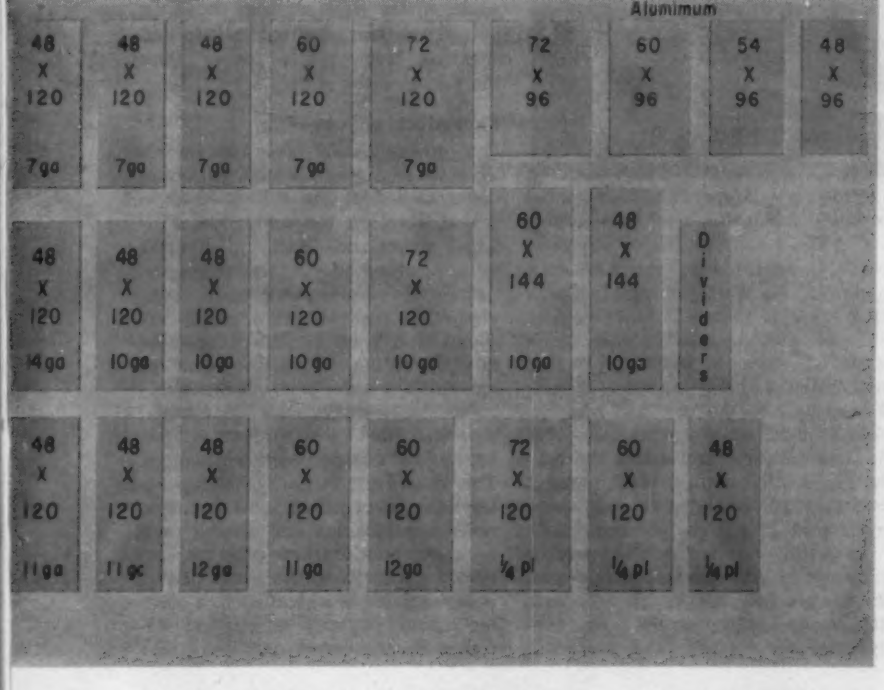
Material stock piles, material handling, and shearing are laid out in a straight line. Sheets are delivered inside the plant by rail cars or trucks. An overhead crane equipped with a special lifter picks up either single sheets by vacuum cups or bundles weighing up to 4000 lb by grip jaws. Groups or bundles of sheets are clamped securely from the sides. Spreader bars on the lifter provide support over the entire underside and protect materials against bending or deforming. The crane is operated by a single man riding in the cab. No helpers are required.

The bundle or sheet is moved to an appropriate stockpile and automatically stopped over the exact center by special limit switches. Each size of sheet or plate is stored according to gage in a designated space clearly marked on the floor and on a layout in the cab of the crane. Bundles are separated from each other by steel channel dividers and are handled by crane.

The same crane then transports complete bundles or individual sheets from any of the stockpiles to an accumulator conveyor with receiving stations for three stacks of materials. If there are only a few sheets to be used, the crane transports the sheets individually. If the majority of a bundle is to be used, the crane transports the entire bundle and then returns the unneeded sheets individually to the original stockpile.

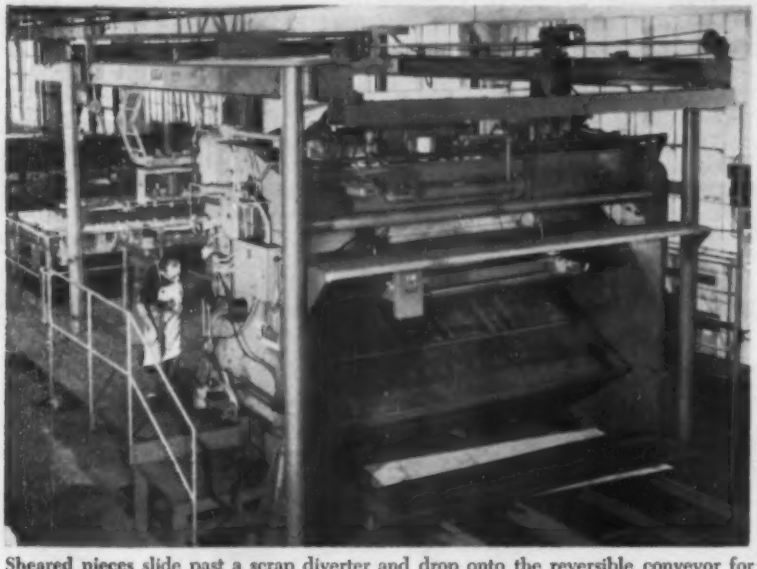
A specially designed overhead traverse-type crane with vacuum lifters transports individual sheets from the accumulator conveyor to ball transfers on the shear table. Light sheets are supported by an additional series of 12-in.-center ball stands mounted in sockets in the floor. Occupying a 12-ft square area in front of the shear, the ball stands can be moved out of the way to provide more working room. Sheets are fed manually or by vacuum lifter from ball transfers to shear.

The speed with which sheets can be fed to the shear depends on the size and gage of the material. To accomplish highest production, the



Orderly material flow . . . Overhead crane equipped with a special lift takes incoming material to appropriate stockpile, according to spaces designated on shop floor and on layout in cab. Bundles or individual sheets are then moved as required to the accumulator table. Here a special traverse-type crane transports individual sheets to the shear table. Reversible conveyor may return cut piece under shear to rotary table floor lift for additional operations or carry finished pieces to rear for stacking

Vacuum lifter on auxiliary crane is removing a sheet from rotary lift for movement to ball stands in front of shear



Sheared pieces slide past a scrap diverter and drop onto the reversible conveyor for movement to stacking area or back under shear to rotary lift table for more cutting

shear has to cycle at a speed to match the operator's capacity to feed materials so as to catch every stroke. Because plates vary substantially in size and weight, cycling speeds of the shear must also be varied.

This is accomplished by use of a Pacific hydraulic shear with adjustable rake and adjustable stroke length. The strokes per minute of this shear can be varied from a minimum of 4 strokes to a maximum of 70 strokes. Maximum strokes per minute are accomplished by shortening the stroke length.

The method for arriving at the required stroke length for a given piece is provided by the following example for 3/16-in. mild plate 3 ft long. This plate thickness can be sheared at ⅛-in.-per-ft rake angle Then the material thickness, ⅛ in., multiplied by the material length, 3 ft, equals ⅜ in. for effect of rake. Add 3/16 in. for plate thickness and ⅛ in. clearance for feeding the material, and the required stroke length becomes 11/16 in., with the shear cycling at 52 strokes per minute.

In cutting 1-in. strips, the operator may not be able to feed faster than 25 strokes per minute. In that case the stroke length can be deliberately increased to 2 in. and the shear will cycle at 25 spm. For 6-in. strips, the optimum feeding speed would be about 15 strokes per minute. The stroke length can be increased to 3½ in. to attain this speed.

Contrasted with the steep cutting angle of a fixed-rake shear, the adjustable-rake feature of the hydraulic shear offers a further advantage in that the minimum rake angle of ⅛ in. per ft eliminates bow and twist of the finished piece.

Thin gage and heavy plate

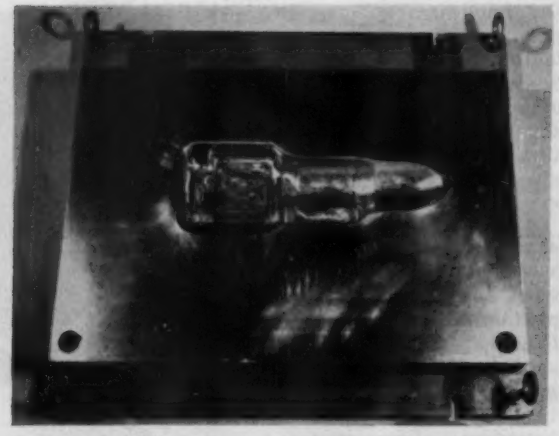
The necessity of cutting material from 26 gage to ½-in. mild steel plate was another factor in favor of selecting a hydraulic shear. Through shock-free hydraulic cutting, the intermediate alloy knives designed for heavy plate stand up well in shearing thin gage. Rake angle and knife clearance are readily adjustable for shearing both thin gage and heavy plate. The line of shearing is illuminated so that the operator can cut accurately to a scribed line. Hold downs operate independently of the upper knife, enabling the operator to double check for accuracy before shearing.

The shear is also equipped with a hydraulically operated power back gage that can be quickly moved to approximate location and then inched slowly to the exact setting. The back gage can be set to move up hydraulically during every shearing stroke, to prevent wedging of narrow strips of heavy plate between lower knife and back gage. In addition, the gage can also move up out of the way hydraulically when shearing large plates longer than the range of the gage.

Reversible conveyor

A hydraulically operated scrap diverter on the discharge chute opens to deflect and collect scrap in a box hung on the underside. Finished pieces slide past the diverter to a powered, reversible conveyor. Set in the return position, the conveyor returns the piece under the shear to a rotating elevating table in front of the accumulator conveyor. Table is elevated mechanically to conveyor level for additional shearing. Sheet can be rotated after lifting for shearing different edges. The shearing and conveying operations can be repeated until the sheet reaches prescribed size. Conveyor is reversed and finished piece is carried to rear for stacking. Small sheared parts are handled in a similar manner on collector pallets stationed on the conveyor.

Only one setup, with one holding fixture, is used to mill, drill, and spotface this aluminum tee fitting for the B-52 missile bomber. Previously, the part required three fixtures and four operations. Now on the Milwaukee-Matic, the job could be programmed manually but computer assisted programming provides verified tape in minutes



Complex die-sinking job was machined at Boeing-Wichita on tape-controlled profiler for a small fraction of manual die-sinking cost—and resinking to compensate for wear can be done from same tape. Computer is essential for programming parts or tools requiring complicated continuous cutter paths. However, Boeing's WALDO system simplifies its use

Tomorrow's numerical control today:

Computer assist speeds all programming

People interested in numerical control have been told, "You don't need a computer for simple point-to-point programming." And this advice is true. However, Boeing-Wichita did such an outstanding job of developing computer-assist techniques for its continuous-path programming that now even the simplest programs go on the computer, cutting time and human error

By Robert C Wilburn, Manager
Boeing Applied Computing Services
Boeing Airplane Co, Wichita, Kansas

Numerical control follows a workflow pattern similar to existing machine planning, tool design, tool and part fabrication routines—with only the substitution of a parts programmer and a computer to interpolate the program into a tape. Once a workable computer program is established, numerically controlled processing becomes routine.

Personnel for such an organization should be selected from related operations. For part-programming, select personnel with profile or milling-machine experience, or tool and production planning knowledge. Having these "basics" they need only become acquainted with the computer program and its vocabulary. Parts programming training for high-school graduates requires only a 120-hour course.

Designing of tools and holding fixtures for N/C is much easier than for conventional machining. Most parts are readily located on flat plates with pins and clamps. Vacuum chucks of Kirksite or cast aluminum plate are easily made. The sealing grooves can be cut by N/C tape to fit the outline of the part. **Tooling of this type does not require as high a skill level as is normally required for conventional machines. However, indexing tools for complex parts still require efficient design and close tolerance workmanship.**

Maintenance personnel should be selected, if possible, from persons now servicing templet-controlled machines. They make the transition more rapidly because their experience lies in a similar field.

Machine operators are easiest to obtain because they need only learn the peculiarities of the new machine. They are relieved of the manual maneuvering of the machine, and are needed to monitor or supplement its actions—such as, start—stop—change cutter—etc.

The Training Department has an important role. Each person must acquire complete knowledge of his new position and be thoroughly indoctrinated in the related phases of numerical control. Complete N/C training knowledge is difficult to obtain as most courses offered by systems manufacturers and machine tool builders are oriented to specific equipment. Training covering all facets of N/C by independent agencies that specialize in N/C is a better answer. Instructors could teach multiple courses at the user company's plant and spare the expense of transporting several employees to some distant plant for training.

In conjunction with personnel selection, setting up an organization

and implementing a training program, another tremendously important factor is equipment selection. So-called simple two-dimensional systems should by no means be slighted—and prior to any selection, careful consideration should be given to how this machine will fit into the overall N/C program.

A more logical plan would consist of programming all systems through a computer which will accept basic input information and produce output information in a form acceptable to each specific control system. With a production proven computer program, up to 75% of the programming time can be saved. With the reduction of manual programming a greater percentage of human error is eliminated. Many built-in checking systems, computations, and short cuts can be accomplished within the computer.

An experienced N/C consultant is highly desirable, especially if one intends to use continuous-path machining systems. Some of the factors worthy of consideration are, briefly: systems reliability, systems repeatability, speed of the reading head, and type of input media. Questions include: What associated or special tape preparation machines are needed? Is the system a filament or transistor type? Can it be used in common shop atmospheres and temperatures? What is the typical maintenance history of such units? Most important of all, especially for continuous-path, is the system capable of complete computer compatibility, and has a post processer been written and *proved* for this particular system?

Selecting die parts

After the machines have been selected and ordered, and the training program is progressing, the parts or dies to be machined should be selected. **The quantities of parts are no small matter when one considers the machining capacity of a machine such as the Milwaukee-Matic. One of the biggest problems with this machine is keeping enough parts, complete with their tooling and tape, ready for machining.** Its ability to machine two different groups of parts almost simultaneously without any machine down-time for setups is a terrific production booster.

Control tapes, holding fixtures, and cutters must all be ready when the machine is installed and capable of production. It is well to know the potential of any machine selected so there will be no lost time in tooling,

Plotter-verifier designed by Boeing provides a visual drawing of the cutter paths to be described in the part directly from the tape. Important uses are part program proving and tape verification. The machine also can create pictures from mathematical data—in any angle of projection, and isometric drawings.

tapes or parts. Remember, numerical control is an expensive investment only when the machine is not loaded and utilized properly. With the proper utilization it is a tremendous profit producer.

Die machining by N/C

Machining form or draw dies is natural for numerical control as both male and female dies can be machined from common input data. Forging dies also fit this category and, with the proper computer program, far greater accuracy and consistency can be obtained than was ever realized with templet-controlled machines—with little or no regard for part complexity. The decrease in operations results in a much shorter flow time.

Tooling philosophy for using N/C is basically in holding fixtures and special cutters. Numerically controlled cutters can usually machine both sides of any part with two simple plate type holders. Tooling cost is generally low compared with tooling involving a series of mill fixtures having common coordination points as used on conventional machines. **Savings in tooling are multiplied enormously when you also consider the L-H and R-H fixture requirements and the extra fixtures required for a series of dash numbers of similar parts or the companion drill jigs or boring fixtures,** not to mention the series of extra setups required for each operation.

Some of the newer users of N/C have already recognized the importance of having a tape which will operate the machine at optimum speeds and feeds regardless of part complexity. They also have recognized the tremendous amount of technical knowledge required to write a first-class computer program and the tape preparation facilities necessary to prepare and verify the machine tapes.

It is no longer necessary for every machine user to write his own computer program, furnish his own tape preparation machines, or verify his own tapes. During the early stages of numerical control this was true, but today N/C training, consulting, part-programming, tape preparation and verifying services can be purchased from service organizations. And the price keeps N/C very competitive. Smaller manufacturers, who have been reluctant to use numerical control because of the technical support groups and computer requirements, find they now can purchase these services and can use N/C to their own competitive advantage.

Even the users of two-dimensional or positioning systems can have the advantage of computer-processed tapes that will eliminate many of the errors in programming. No longer must they utilize critical machine time for proving tapes.

Installation of N/C equipment follows the normal pattern of heavy machine installations. Foundations built into machine-tool builders' specifications are usually suitable.

Power requirements are in some cases critical, as voltage drops may result in erratic electronic system operation. **Most important in this area, is having the machine-maintenance group ready to give full support, not just as trouble shooters but in a well-planned preventive-maintenance program** that will assure completely satisfactory machine operation during its scheduled production periods. These machines, even with their complex systems, are extremely reliable. Boeing's continuous-path machines have operated for three years—most of the time three shifts, six days per week on a heavy production schedule with an average down time for both scheduled and non-scheduled maintenance of only 8.3%.

Before acceptance of any machine, the purchaser should perform certain cutting tests to prove the tolerance and operation capabilities of the machine on location in his plant. Here also the part programmers and other personnel have the opportunity to learn the exact capabilities.

To successfully machine at certain speed and feed rates and to specific tolerances, the machine must be completely understood by the maintenance, tool design, and part-programming personnel. And these people must work as a team. Once this has been accomplished the production flow maintains a normal and uninterrupted pattern. Failure to observe or maintain any of their predetermined responsibilities will mean failure of the tape to successfully machine a part.

Even loading schedules

Machine shops have always been a difficult area in which to establish an even loading schedule. **With the advent of N/C, machine times correspond to known tape times for the major portion of hours, leaving only the short setup time to be estimated. Some N/C machines such as the Milwaukee-Matic can run continuously, as setup time does not cause the machine to stop.**

The ability to repeat within extremely close tolerances can reduce or eliminate the need for master tooling, or coordinating tools such as drill jigs or boring fixtures. The tapes, in effect, become the tools and can be easily stored for later use without the expense of storing a large quantity of jigs and fixtures. Dies can be easily recut to the original tolerances from stored tapes without the trouble of storing and maintaining patterns.

Companies using N/C can testify to the definite improvements in the quality of the machined parts. For example, an 80-ft. wing skin of the B-52 that had a thickness tolerance of 0.010 in. was held to 0.003 in. on the low side of the tolerance and its weight was reduced 19 pounds.

Comparative machining costs

Other examples are to be found in the handling of wing panels for the B-52. Actual dollar cost of a lower wing panel (computed from manhours required up to the time of machining) via conventional methods on a spar mill was $18,467. Cost of the same component before machining on an N/C skin mill was $1,958. Savings on this part of the work along was therefore $16,509.

New machine design concepts as well as new control systems are on today's horizon. Many of the solutions of today's N/C problems have opened gateways to entirely new applications of N/C. For example, greater reliability of control systems, and new tape preparation and verification techniques make it possible for Quality Control to participate in the early part programming phases. Here they may exercise a control of quality to assure a perfect tape prior to the tapes entry into the actual machine.

Shop inspection

A routine shop inspection would be for the inspector to witness "setpoint zero" of the *xyz* axes and, later, the return of the machine to this same point, thus assuring complete compatibility during machining. Inspection in this manner would minimize the duplication caused by inspecting the part with a stylus operating an identical control system, and greatly reduce the inspection time while assuring better quality.

Tapes can be proved to Quality Control's satisfaction by close tolerance plotting of the cutter paths that define the part. This plotter drawing in three plan view operated by a control system of 0.000,025 inch accuracy and a machine of 0.001 inch accuracy is only limited by the mechanics of the machine.

Sources of error

Under actual operation on a precision machine tool the tape would complete a precision part. Less than 1% of the errors occur as "machine malfunction" or "operator error," and these are usually extreme gross errors, easily detectable. **Programming errors, the other 99%, can be detected by this method after only one pass through the computer, greatly reducing the flow time and cost of preparing erroneous tapes.**

Also, this one piece of equipment would service any make of machine, as the information used is not associated with any post processer. This immediately eliminates the requirement for specialized, verifying equipment for different control systems.

Computer centers

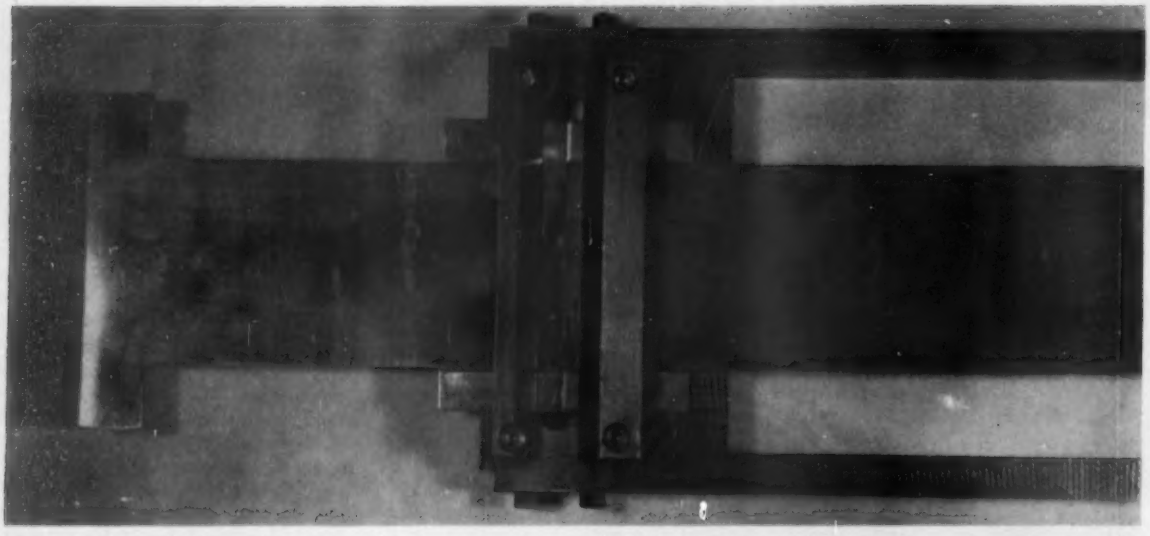
New computer centers, we believe, will play significant roles in efficient utilization of tomorrow's machines. Small machining companies that have been reluctant to use the new computer-controlled machines, because of the complexity of producing tapes for their parts, no longer have a basis for this fear. Many two-dimensional parts can be machined by manually programmed tapes. However, the services of a computer, with the proper computer program, can prepare the tape in one-fourth the time. Not only is the flow time and cost reduced, but the benefits of many built-in checks can be invaluable.

For example, a computer program for the Milwaukee-Matic has reduced part-program flow time by 40% to 75%. The more complex the part, the greater the reduction in programming time. Also, on a comparison of over 100 Milwaukee-Matic parts programmed manually versus similar parts programmed with the computer program, errors were reduced 65%. Average computer time was from three to five minutes per part.

Coming: 4-axis machining

Machine tools are being developed that will allow machine motion in four or more different axes. Post processers and computer subroutines need to be written and proved so these new machines can be properly utilized.

There is no reason why tomorrow's factory, its equipment, its manufacturing techniques, even its material flow, cannot be planned today. Existing companies should diligently consider modernizing their facilities using the numerical-control concept. **Even though the numerical-control machines are more expensive, they are comparable ratio-wise by at least 3 to 1 over conventional machines, with the capability ratio going as high as 10 to 1 in other categories of machines, thus offsetting their initial costs.**



Inexpensive fixture holds parts with joint offset from center so copper (left) will be heated more than stainless. Heavier hold-down bar for stainless helps to keep it cooler. Assembly is welded inside a Plexiglas inert-gas chamber

Tig welding joins copper to stainless

You CAN join copper and stainless steel by Tig welding (Tungsten-arc, inert-gas), but you've got to be very careful about heat balance in the two metals. The object is to put most of the heat into the copper and fuse it to the stainless rather than melt the two metals together.

By Dr J M Gerken,
engineering supervisor—welding, Material Dept,
Thompson Ramo Wooldridge, Cleveland, Ohio and

D B Kittle,
metallurgical technician,
Knolls Atomic Power Laboratory, Schenectady, NY*

*Knolls Atomic Power Laboratory is operated by the General Electric Company for the United States Atomic Energy Commission.

Knolls Laboratory worked out a technique for this joint because of an experimental heat exchanger in which stainless steel strips were to act as electrical resistance heaters. Each end of each strip had to have a copper tab so it could be connected to the power supply.

Even though these joints between copper and Type 304 stainless had to have complete and uniform conductivity, we produced them with inexpensive fixtures and without metal backing.

In thicknesses of 0.050 and 0.075 in., we made a single pass from one side, but we found that 0.110-in. sheet requires a pass from each side to complete the joint without excessive drop-through.

In order to get the copper hot enough and still keep the stainless steel from getting too hot, we deviated from normal procedures in several respects. One was to fixture the parts so as to expose more copper than stainless to the arc's heat.

The carbon-steel fixture allowed a half-inch working space between hold-down bars. Into this space the stainless projected only 3/16 in., compared with 5/16 in. for the copper. These distances turned out to be critical in relation to the other welding conditions, such as arc current and travel speed of the electrode.

The off-center arrangement also meant that the center of the electrode followed a path 1/16 in. away from the joint—and over the copper. This, of course, put more heat into the copper.

Sheet Thickness (in.)	Current (Amps-DCSP)	Arc Volts	Travel Speed (ipm)	Argon Flow (cfh)	
				Torch	Chamber
0.050	120	9.5	8.6	20	30
0.075	150	10	7	20	30
0.110 1st pass	190	10	8.6	20	30
2nd pass	190	10	10.5	20	30

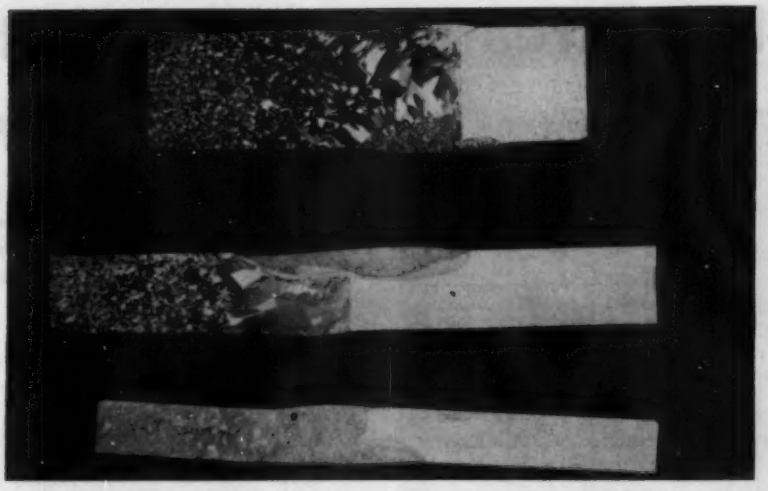
The electrodes were thoriated-tungsten, 1/16 in. in dia, for the 0.050 and 0.075-in. joints and 3/32-in. zirconium-tungsten for 0.110 in. An automatic-voltage-control head held the welding torch and maintained a constant arc length.

Starting and run-off tabs for the two heavier joints (0.110 and 0.075 in.) were of the same thickness and material as the pieces to be joined. This provided a copper-to-stainless transition joint from start to finish. For the 0.050-in. joint, the starting and run-off tabs were solid copper on both sides of the joint.

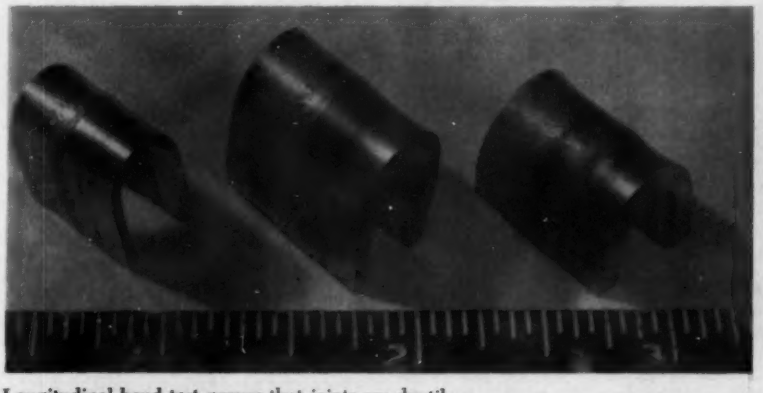
After the workpieces and the tabs were clamped accurately in the fixture, the assembly was placed inside a Plexiglas inert-gas chamber. Then, before each pass was started, the chamber was flushed for at least three minutes to make sure the work was completely surrounded by argon gas.

When the joints were completed, we encountered some difficulty in testing the bond because of the two different materials involved. A tensile test or transverse bend test would obviously yield first in the more ductile annealed copper adjacent to the joint.

Furthermore, the depth of penetration or bonding wouldn't show up on radiographs, because the density of the two materials obscured the interpretation. However, a longitudinal bend test indicated that the joint was very ductile, and a peel test showed the bond to be complete.



Copper (left) fuses to stainless rather than both metals melting and fusing together



Longitudinal bend test proves that joints are ductile

Solve Brinell hardness with simplified formula

The Brinell hardness test is useful in the small shop or laboratory. In this test a hard ball is placed on the work and a known load is placed on the ball sufficient to make a permanent impression in the metal surface. The diameter of the indentation is measured and with this information the Bhn is computed:

The exact formula is:

$$Bhn = \frac{P}{\pi\,(D/_2)\quad(D-\sqrt{D^2-d^2})}$$

where: Bhn = Brinell Hardness Number
P = Load on ball in kilograms
D = Ball diameter, mm
d = Indentation dia, mm

Use of this formula is tedious.

This simplified formula substitutes the projected area of the indentation for the exact area of the indentation surface, and includes a subtractive term to reduce error to a minimum.

$$Bhn = \frac{P}{A} - 10 \qquad \text{or} \qquad Bhn = \frac{4P}{\pi D^2} - 10$$

This equation is sufficiently accurate for most purposes.

TABULATED VALUES

Approx. Bhn	True Bhn	Error, %
50	48	4. %
75	74	1.3%
100	99.5	0.5%
200	200.0	less than 0.1%
500	500.3	less than 0.1%
1000	1000.4	less than 0.1%

This tabulation shows the trend and magnitude of the error. For large Bhn values the (–10) may be left out.

The formula is easy to remember: "Divide four times load by the projected area and subtract ten."

The ASTM standard test uses a 3000-kg load and a 10-mm ball for iron and steel and 500 kg for soft metals. The load should be left on for 30 sec. or more. For Bhn values above 500 use a tungsten-carbide ball. The indentation can be measured with an inexpensive pocket comparator of the type that reads to 0.001 inch. The reading must be expressed in millimeters.

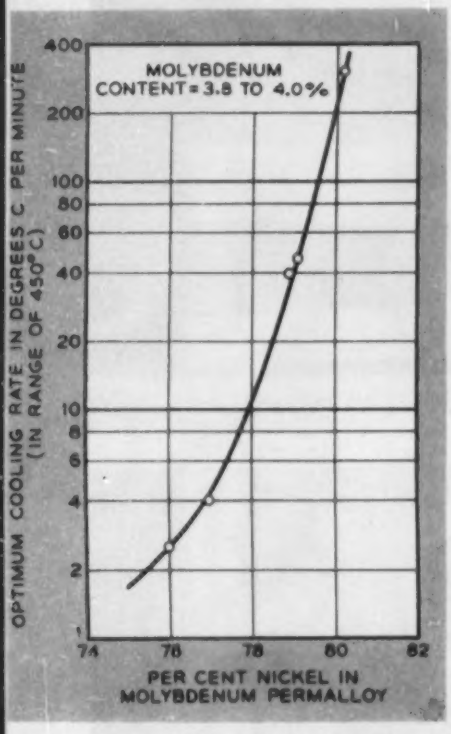
The metal tested should be at least ten times as thick as the indentation depth and the width should be such that no metal flow toward the edges takes place. The surface should be smooth and free of defects.

Heat treating electrical steels

—*Why all the mystery?*

Lack of down-to-earth guidance needlessly complicates the job of heat treating high nickel and silicon steels on a production basis. Here are a few basic tips to help bridge the gap between the steelmaker's lab and production heat treating

By John J Lawless, Jr, Vice president, Metallurgical Consultants, Maywood, Calif



Even a slight variation in percentage of one alloy constituent of electrical steel has a serious effect on the heat treating procedure. Addition of only a small amount of nickel in the 4% Mo Permalloy composition drastically increases the optimum cooling rate. (Curve is from "Ferromagnetism" by Richard M. Bozarth, D. Van Nostrand Co., Inc., N. Y. 1953)

There are so many contradictory theories about heat treatment of electrical steels that it is surprising that they're used at all. Yet they are —extensively—in spite of the conflicting and frequently mystifying data published for the guidance of users.

The trouble lies in the huge gap between laboratory and production methods. Results attained in the lab with small quantities of steel are vastly different from those obtained in working large volumes of metal on a production basis.

Reams of data are available, for example, on the magnetic properties of electrical steels, but information on how to heat treat those same steels is sketchy, to say the least. More often than not, such heat treating data as is available is based on laboratory processing conditions unattainable on a production basis.

For instance, much has been published on composition, treatment and application of electrical steels, but almost invariably these observations have been based upon closely controlled experiments involving only a very small quantity of metal. Not only that, published data usually relates only one effect with one processing condition.

Obviously, then, what is urgently needed is a set of ground rules for shops that must heat treat electrical steels — rules that will help bridge the gap between scientific theory and the actualities of production.

Any such recommendations must be based on recognition of the differences between laboratory and production practices. In production heat treating, for example, the effect of mass produces varying rates of heating and cooling. And the larger volumes of material is bound to introduce more absorbed air and other contaminants into the furnace—all of which must subsequently be removed in processing.

For this reason, variations in electrical properties, caused by furnace treatments, must be very closely controlled between the processor and the ultimate user.

Needed: quantitative data

There is certainly a serious need for quantitative data on the effect of dew point, temperature control, rates of heating and cooling at all temperatures, and on surface conditions developed in processing—as related to metallurgical and electrical properties of the product.

When identical lots of material are processed in exactly the same way, it can be assumed that their properties will be identical. But when the steelmaker for one reason or another slightly varies the composition or condition of one lot, processing multiplies this variance into a whole new range of properties. There are thus hundreds and hundreds of these deliberate varia-

Magnetic materials require careful preparation for annealing. Here each part is individually placed in a tray and packed in aluminum oxide powder. Five or six such trays go into the retort together.

tions, each with its own range of properties.

Take, for example the simple electrical steel shields that protect instrument components from the influence of stray magnetic fields. A discerning buyer certainly must wonder whether 15¢ a pound for heat treating is consistent with $2.50 a pound for the steel.

Allegheny Ludlum's Mumetal (a good example of this steel) is anywhere from 96% to 97% effective at flux densities ranging from 30 to 300 gausses. In unannealed condition, shielding effectiveness varies from 55% to 75%.

But ordinary low-carbon steel has an effectiveness of 80% to 90% in annealed condition. Thus at high flux densities, and for certain requirements, it might be a waste of expensive alloy to employ Mumetal in an unannealed or partially annealed condition when annealed low-carbon steel shields could very well be more effective.

At lower flux densities, the effectiveness of unannealed Mumetal falls quite low (as does that of unannealed or annealed low-carbon steel) so that a low-cost annealing treatment for Mumetal shields that are to be subjected to lower flux densities may be economically practical if the sensitivity of the device to be shielded isn't critical.

Too often, steelmakers and researchers specify a single heat treatment to apply to all magnetic materials. The same treatment is specified, for example, for Mumetal and Moly-Permalloy.

Not only that, variations in material analysis of a metal are often overlooked, yet they can seriously affect magnetic properties resulting from heat treatment.

Treat at 2050 F on Coast

This effect can be even more important in such sensitive materials as Supermalloy, but it is almost universal practice on the Pacific Coast, for example, to specify that high-nickel electrical steels be treated at 2050 F and cooled at 100 F per hour.

Admittedly, from a production standpoint too many specifications can be undesirable and in some cases downright unnecessary. Even so, an overabundance of specifications is better than allowing the user to buy expensive materials, then treat them by a process that realizes only 75% of their potential.

Generally, faithful execution of a technically correct heat-treating specification means that "pool loading" cannot be used (indiscriminate loading of several lots of materials for simultaneous heat treatment). Pool loading is a great cost cutter, however, and it is possible to use it under the most rigid heat treating specifications if materials which can be pooled together are carefully selected.

Cores and shields

Core and shielding materials, for example, break down into three types. The metals within each of these types require almost identical heat treatment. Type 1 consists of 49% and 79% nickel materials, Type 2 of such special application steels as Trancor-T and U S Steel's Transformer Grade 80, and Type 3, which includes such relatively pure iron as magnetic ingot iron.

Protective, sometimes reactive, atmosphere must be used in heat treating furnaces for all of these materials. Type 1 and Type 3 steels can be improved if the atmosphere is reactive with residual contaminants such as silicon, carbon, sulphur and oxygen. The effectiveness of this purifying reaction depends upon the use of extremely pure dry hydrogen.

The combined oxygen, moisture, sulphur, and carbon in the atmosphere gas should be less than 10 parts per million so as to provide a potential for purification, rather than contamination.

The equilibrium of contaminants in the hydrogen atmosphere with those in the parts being treated is most important. Thus, the gas must not only be pure as it enters the heating chamber, it must be changed frequently enough to control its purity as it is subjected to the work.

A safe way to control equilibrium: Monitor the dew point of gas as it enters and leaves the work space. A dew point of –100 F at entrance and –70 F at outlet usually insures that the gas flow is enough to compensate for contamination picked up from the furnace or parts. Although requirements differ with the job, an outlet dew point of –65 F is satisfactory for about 75% of all jobs.

For Type 2 steels, the mills advocate a neutral atmosphere of extremely low carbon content, because even 0.01% increase in carbon content can appreciably lower the performance of such steel. Even though nitrogen or a nitrogen-hydrogen mix is usually recommended for the operation, pure dry hydrogen is less costly and is much easier to purify. Moreover, hydrogen acts much like an inert gas at the usual annealing temperature for silicon steels.

"Economizing" on the time cycle in annealing high-nickel electrical steels is one way of cutting down on costs. A reduction of normal soak time, for example, also reduces the degree of purifying in the hydrogen reaction. For silicon and some nickel materials, an increased cooling rate may produce stresses that reduce magnetic performance, and it may fail to produce an ideal degree of ordering of metal crystals. However, some nickel materials improve if they are cooled somewhat more rapidly, but on the other hand excessive soaking may develop coarse grain that is frequently undesirable.

Sometimes "full annealed" nickel alloys (with low-temperature equilibrium attained by slow cooling) do not have the best properties for an application.

In many instances, a perfectly ordered metal crystal lattice is not suitable. Consequently, temperature sequences and cooling treatments must be chosen so as to produce the optimum ratio of order to disorder in the crystal lattice.

But it cannot be overemphasized that indiscriminate adjustments to a specified cooling rate, or treatment time, can prevent a required metal structure from developing, thereby producing inferior properties in an electrical steel.

Long and often high-temperature operating cycles, incidentally, may require special furnace features. For example, the work must be loaded in a gas-tight retort which completely excludes air or gaseous contaminants. Similar control of gas inlet piping is essential.

A purifying train is also essential. This must include a catalytic tower (for reduction of traces of oxygen to moisture), and a drier (for removing moisture to a low dew point, preferably below –100 F).

Construction of the tight retorts required for sustained operation (several hours) at 2050 F is not a simple undertaking. Some experts recommend welded boxes with welded covers that can be removed after treatment by cutting the weld away. But more reliable and more convenient than a poorly welded seal are water-cooled neoprene gasket seals.

Of the several materials for high-temperature retort construction—Inconel, Mumetal, 330 stainless, and low-carbon steel—the author's experience has been almost exclusively with Inconel, which performs almost indefinitely at high temperatures.

14 steps TO DESIGN A DIE

STEP 13

Dimensioning and Notes

Part 3 — Blanks for Drawn Parts

By J R PAQUIN, supervisor,
Tool Engineering Dept.,
Cleveland Engineering Institute

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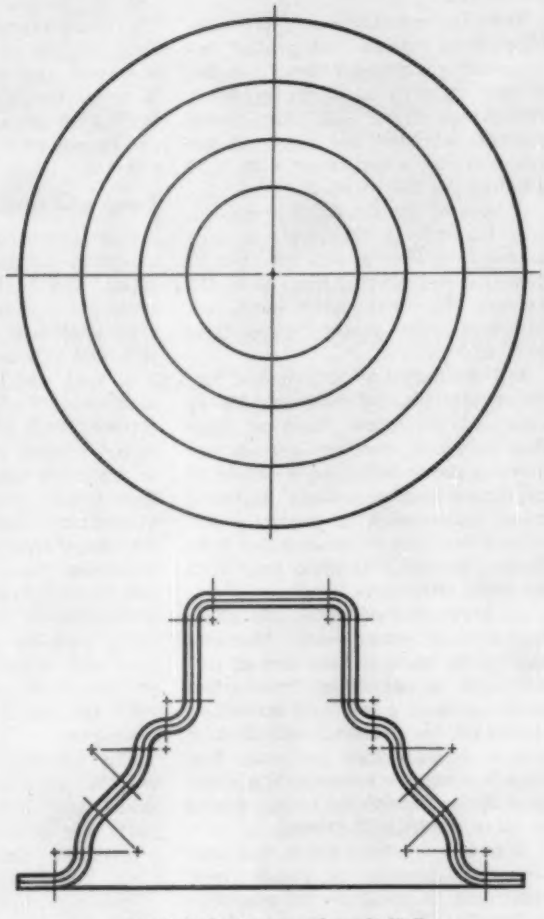
Before a die for producing a drawn cup or shell can be dimensioned, it is necessary to determine the diameter of the blank. This dimension must be calculated before the design is begun, because the diameter to which the first cup can be drawn has a direct relationship with the diameter of the flat blank. Also, the blank diameter must be known before the blanking die can be laid out.

You should know that blanks for drawn parts cannot be developed in the same manner as blanks for bent or formed work. In drawing, metal is gathered or moved from all sides simultaneously, and the developed length will be shorter than for corresponding bent or formed workpieces. Therefore, for drawn shells, an accurate dimension for the flat blank will not be obtained by adding lengths of portions of sections. Instead, you must determine areas of *various* sections of the shell and compare their sum with the area of the flat blank. The two must be equal.

There are two methods of determining diameters of flat blanks for drawn shells:

1. They may be calculated mathematically. First the drawn workpiece is separated into its component rings and disks and the area of each is determined by appropriate formulas.

2. Some forms are better developed by a graphical layout. This method is accurate and relatively fast if properly understood. We will now undertake the study of both methods.

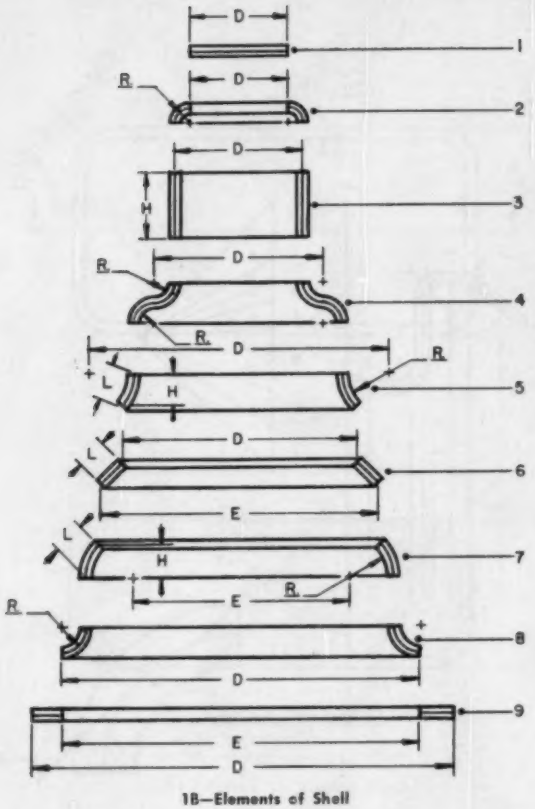


1A—Multiple-Diameter Flanged Shell

1 . . MATHEMATICAL METHOD. The flanged shell 1*A* is to be drawn to several diameters. Divide the shell in flat disks and ring-shaped sections, as shown in 1*B*. The areas of all sections must be calculated. Their sum squals the area of the developed blank. The diameter of the blank is then found in a table of diameters, circumferences and areas of circles, or calculated. (The blank diameter equals the square root of the area multiplied by 1.128)

Formulas are given at 1*C* for solving for the areas of each of nine representative sections. These formulas determine the area of the neutral surface.

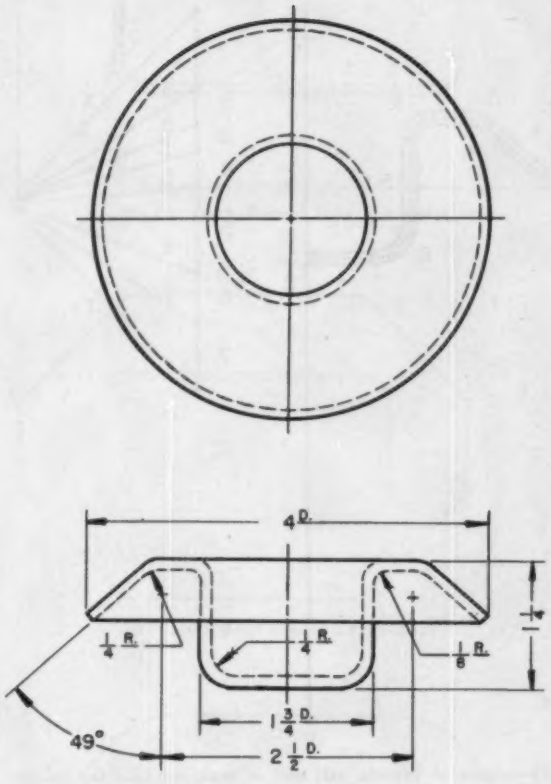
When you are confronted with the problem of developing the flat blank for a round shell, first divide it into elementary forms as shown. If all of the forms correspond to the shapes illustrated, it is a simple matter to calculate the area of each. Their sum will represent the area of the entire shell at the draw line along the center of its thickness. This sum will also represent the area of the flat blank if no stretching occurs. The corresponding diameter is given on the drawing of the blanking die followed by the word "TRY". The diemaker will make a blank by hand and try it in the drawing die before starting to build the blanking die.



1B—Elements of Shell

	1.	$D^2 \times .7854$
	2.	$2\pi R^2 + \frac{\pi^2 R D}{2}$
	3.	$\pi D H$
	4.	$\pi^2 R D$
Area =	5.	$\pi (D L - 2 R H)$
	6.	$\pi L \left(\frac{D + E}{2}\right)$
	7.	$\pi (D L + 2 R H)$
	8.	$\frac{\pi^2 R D}{2} - 2\pi R^2$
	9.	$\frac{\pi (D^2 - E^2)}{4}$

1C—Formulas for Areas of Shell Elements



2A—Shell for Graphical Solution, p132

2 . . GRAPHICAL METHOD. Shells may be developed graphically by application of the theorem of Pappas and Guldinus, which states that the volume of a body generated by revolving a plane section about an axis in the same plane of the section may be found by the formula:

$$V = 2\pi \times D \times A$$

where: V = Volume of shell

D = Distance of the center of gravity of the section from the axis of rotation.

A = Area of the section.

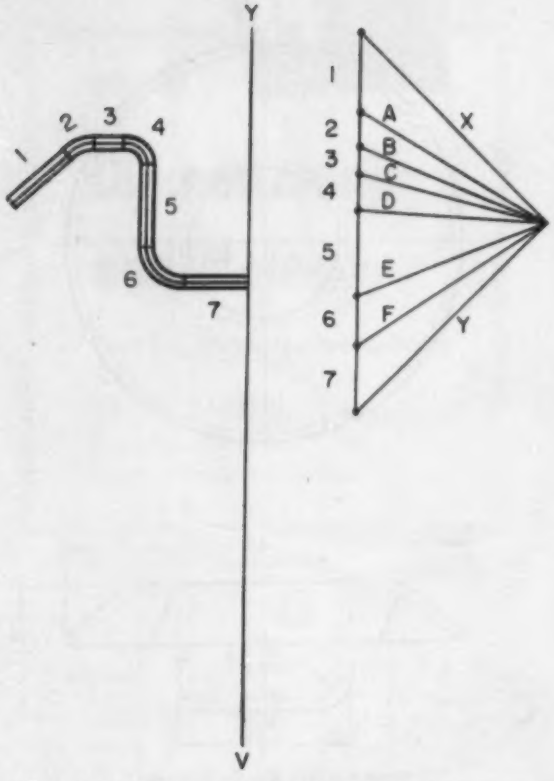
The method is relatively simple. Let us apply it to a flanged shell, 2*A*. Proceed as follows:

Draw a section through the left half of the shell and divide it into its component arcs and straight sections as shown at 2*B*. Also draw a longitudinal line along the center of the thickness. Next apply a centerline $Y - Y$ at the center of the shell. If the shell is small, draw the section to enlarged scale.

Number each section. At the right of the view 2*B* draw a vertical line and divide it into lengths to correspond with the lengths of the shell sections 1 to 7, measured along the center of the thickness. Solve for lengths of arcs, using formulas given in Part 2 (*AM/MM*—Oct 17 '60, p 109), or measure them along the center using a flexible toolmaker's scale.

Draw lines *X* and *Y*, each at an angle of 45°.

Extend lines from division points on the vertical line to meet



2B—Lengths of Sections, Left Half of Shell, Are Laid Out on Vertical line and Numbered to Correspond

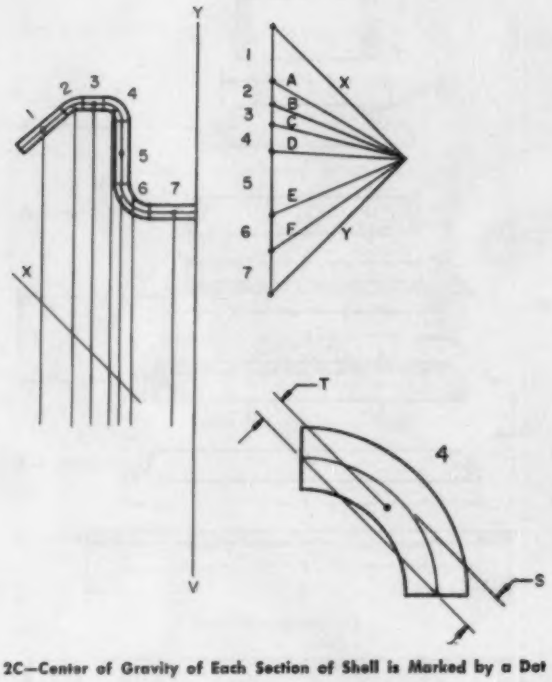
the intersection of lines *X* and *Y* as shown, and label them *A*, *B*, *C*, etc.

Mark the center of gravity of each section of the shell as shown by heavy dots on view 2*C*. Note that the center of gravity of rectangular sections is at the center of each section. The center of gravity of a circular arc is 2/3 of arc thickness *S*, measured from the chord. This is shown as distance *T* in the inset. Extend vertical lines downward from the center of gravity of each section. Below the section view, draw a line *X* at the same angle as line *X* in the diagram at the left.

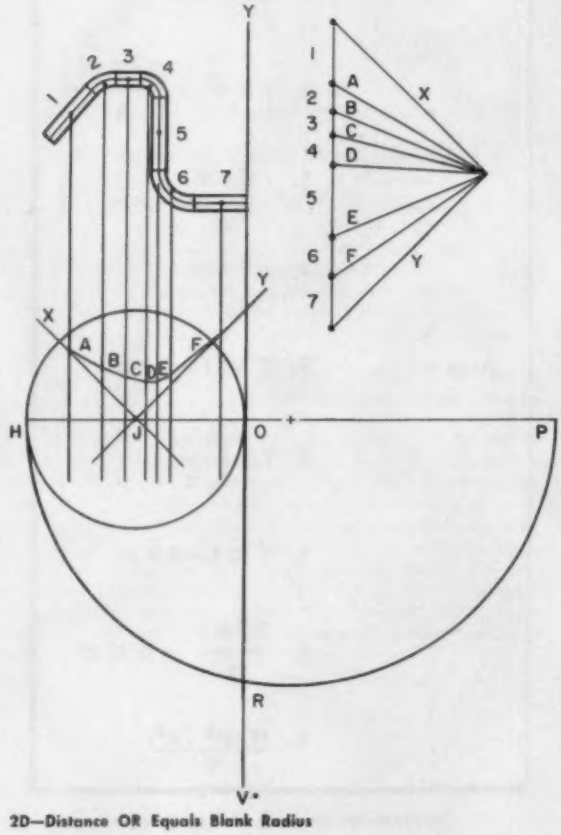
Set the protractor to the angle of line *A* in the diagram. With this setting, draw a line *A* below the section view as at 2*D*. Locate it from the intersection of line *X* and the vertical line from section 1, and extend it until it intersects the vertical line from section 2. Next, set the protractor to the angle of line *B* in the diagram, and on the section view draw line *B* from the intersection of line *A* and section 2 to where it intersects the vertical line from section 3. Continue in this manner until all lines in the diagram have been transferred to below the section view and drawn to the same angular positions. Next draw line *Y* and continue it until it intersects line *X* at *J*.

With *J* as center and with *J-O* as radius, draw a circle *O-H*. Then draw a long, horizontal centerline to cross point *J*.

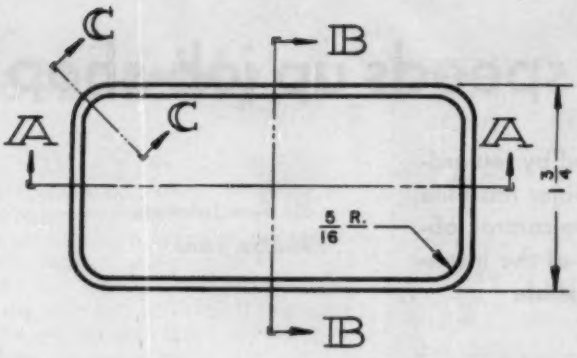
Make line *O-P* the same length as the vertical line 1 to 7 in the diagram at upper right of 2*D*. With the compass point on line *H-P*, and with the compass set to one-half its length, draw an arc with the left end tangent with circle *H-O*. The length of the vertical line *O-R* is one-half the diameter of the flat blank required for the shell if the section view was drawn actual size.

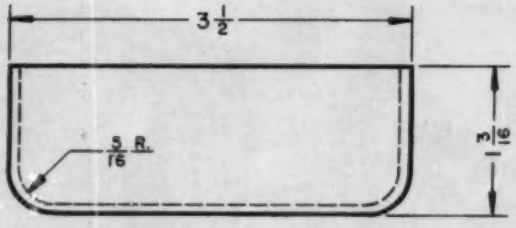


2C—Center of Gravity of Each Section of Shell is Marked by a Dot



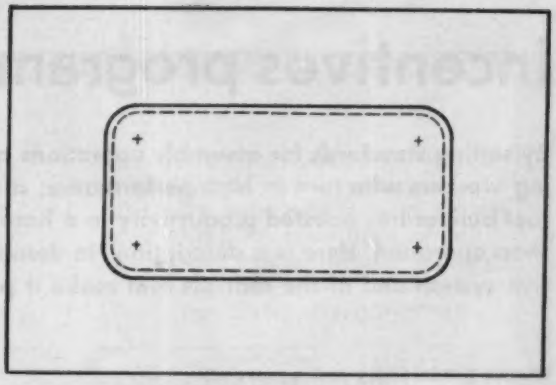
2D—Distance OR Equals Blank Radius



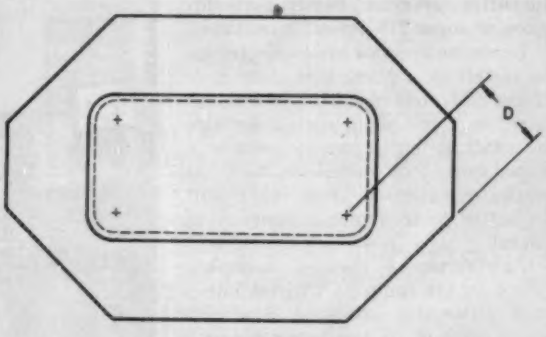


RECTANGULAR SHELL
*16 GA. (.0625)

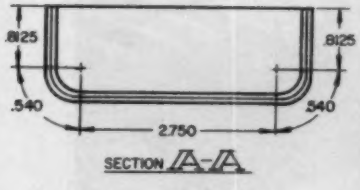
3A—Problem: To Develop Blank



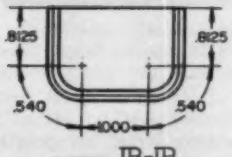
3C—Flat Blank Derived From Dimensions



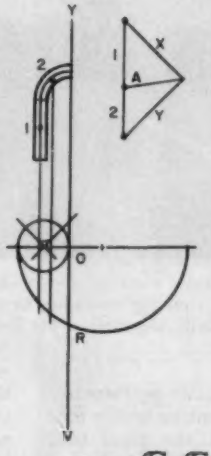
3D—Corner Metal Removed From Blank



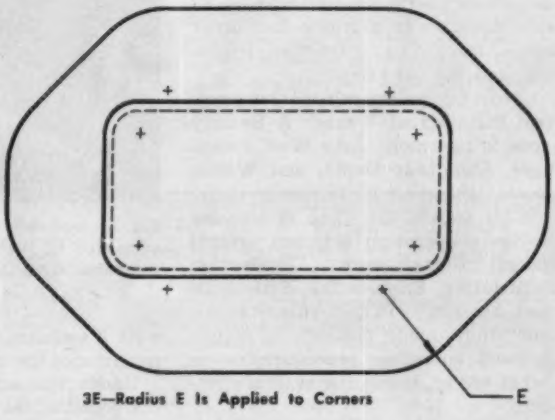
SECTION A-A



SECTION B-B



SECTION C-C



3E—Radius E Is Applied to Corners

3B—Shell Is Dimensioned and Blank Radius Is Solved Graphically

3 . . SQUARE AND RECTANGULAR SHELLS. We will use a combination of the methods described for developing blanks for formed workpieces and for round drawn shells. At 3*A* is shown a part drawing for a rectangular drawn shell to be developed to a flat blank. Three steps are required:

1. Sections *A-A* and *B-B* in 3*B* are taken through the long and short sides of the shell and dimensioned from dimensions given in the part drawing and by employing the formulas given previously.

2. Section *C-C*, in Fig. 3*B*, taken through the corner of the shell to the center of the radius is drawn and developed by the graphical method. Radius *O-R* is called the blank radius.

3. As shown at 3*C*, a rectangle is drawn to represent the length and width of the flat blank. Its length equals the sum of all dimensions of the sections at *A-A*, and its width equals the sum of all sections at *B-B*. Centered within the rectangle is drawn an inverted top view of the finished shell. As shown at 3*D*, 45° lines are drawn at the corners to show the corner metal removed. Dimension *D* is made 0.9375 times the blank radius and it is measured from the center of the corner radius of the finished shell. In other words, multiply length *O-R* by 0.9375, and this figure will be dimension *D*. As shown at 3*E*, radiuses are drawn at all corners of the flat blank. Radius *E* of the blank is made the same as distance *D*.

Incentives program speeds up job-shop

By setting standards for assembly operations and by rewarding workers who turn in high performance, a major machine tool builder has boosted productivity in a hard-to-control job-shop operation. Here is a description—in detail—of the incentive system and of the controls that make it possible

By Tom Johnson,
associate editor

Higher productivity and a more efficient operation . . . that is the happy experience of the Warner & Swasey Co in its Cleveland plant, where an incentive program boosts performance of some 275 assembly workers.

Incentive systems are hard enough to install in a plant that mass produces only one product. When the plant is a job shop, with a lot size as small as ten to twenty units at a time, setting up incentives becomes *really* complicated. But the payoff in better performance is simple and direct.

At Warner & Swasey, assembly work on the company's turret lathes and automatic chucking machines (and some of its textile machinery) follows a precise pattern of standards and controls, to which incentive bonuses are keyed. These assembly incentives neatly dovetail with separate incentive programs in four other areas: machining, inspection, trucking, and the stockroom.

Credit for the smooth-working system installed at Warner & Swasey goes to two men: John Wolf (manager, Standards Dept), and Walter Goetz (group leader in charge of assembly standards). The system involves cooperation between several plant departments: Production Scheduling, Engineering, Standards, and Assembly. In fact, this close cooperation—made possible by standardized operating procedures — is what really makes the system effective.

Fig. 1—Assembly operator receives step-by-step instructions for each assembly operation that he performs on the machines in the rear. His actual performance, later compared with standards, determines his incentive bonus

Main elements of system

This article describes, in detail, the application of incentives to assembly work. Here are the main elements of the Warner & Swasey system:

- Engineering designs are translated into assembly paperwork.
- Time standards for each operation are developed.
- Each assembler gets detailed instructions on the work he is to do.
- After the assembly operation, comparison of actual performance with a standard for the performance determines the incentive bonus paid.

Under this setup, the plant is in full control—at all times—of men, materials, and methods required for assembly work. Only with such standard controls does an effective incentive system become possible.

The system in detail

Now let's look at the system in detail—step by step. (The schematic reproduced on p 136-7 shows the paperwork flow from receipt of manufacturing order until the assembly operation has been completed.)

Once it receives the green light to start processing a newly designed machine or unit, the Engineering Dept prepares two items: blueprints and parts lists that pertain to the new machine or unit. In Production, an engineering release clerk makes up, from the parts list, a stock card from which a job list will be made.

Now the drawings and parts lists go to the Assembly Section of the Standards Dept. Here a group leader sends them to routers who fill out, in pencil, three new forms (see No. 4, 5, and 6 on the schematic):

- *An assembly routing sheet* (also called an *operation sheet*) that briefly describes, in sequence, each operation performed to assemble a unit.
- *An assembly parts list* (copied from the engineering parts list) that shows parts needed for each assem-

assembly

bly operation. Here the parts are grouped into sub-divisions—one for each operation listed on the operation sheet.

● *Shop setup cards* for each operation that list, in detailed sequence, the step-by-step instructions to perform the operation.

Adding time standards

When these three forms have been filled in, they are sent (along with drawings and layouts) to a rater, also located in the Assembly Section of the Standards Dept. Here standard time rates are pencilled in on the operation sheet. For each operation an allowed assembly time, plus a setup allowance, goes alongside the description of each operation.

For most operations the rater applies standard times by consulting a manual developed by the Standards Dept. If a time standard is not available at this stage, a standards engineer develops it in the shop. Thus each operation affecting incentives is covered by standards when paperwork leaves the rater.

Once all rates are on the operation sheet, it and the other handwritten forms go to the Clerical Section of the Standards Dept, where typists make ditto masters. Reproduced copies of these masters become the formal instructions to the shop for the assembly operations.

Instructions to the shop

Once the basic paperwork has been reproduced, assembly procedures swing into full gear. Production Scheduling sends its job list (No. 10 on the schematic) to the Standards Dept, requesting release of all paperwork.

When it receives the job list, the Standards Dept releases all paperwork in the following form:

(1) It makes up a "traveler" envelope, on which the operation sheet is reproduced (see No. 11 on the schematic). Inside this envelope goes the following paperwork:

● One yellow operation sheet, exactly like that reproduced on the traveler envelope.

● Two copies of the assembly parts list (see No. 12 on the schematic).

(2) It sends reproduced copies of the setup cards to the assembly shop, where they are filed. When actual assembly begins, workers

SALES ORDER NO.

MFG. ORDER NO. 11 — DUE IN STOCK

PART NO. M 3204

UNIT & LOT NO. — FOR:

NO. OF PARTS

PURCHASE ORDER NO.

RELEASE DATE

NO. 2 AC FEED & THREADING TRANSMISSION, WITH FIVE HYDRAULIC CLUTCHES WITH HIGH-LOW CLUTCH & GEAR DRIVE FROM SPINDLE WITH VALVE BLOCK & MOUNTING BRACKET

SHEET NO. 1 OF 2

USE UNTIL M-3200-LOT 42

DEPT. NO.	SP. NO.	PC. PER UNIT	ALLOWED TIME PER PC.	SET UP	OPERATION DESCRIPTION
64					WITHDRAW PARTS & DELIVER
51	10A	1	.113	.20	ASSM. GLAND BUSHING & FLANGE
51	10B	1	.076	.04	ASSM. PARTS TO PINION SHAFT
51	20A	1	.550	.30	ASSM. PARTS TO UPPER CLUTCH SHAFT
51	20B	1	.689	.18	ASSM. SHAFTS GLAND ETC. TO CLTCH HOUS.
51	25				HYDRAULIC TEST
51	30A	1	.050	.10	ASSM. BEARING & KEY TO SHAFT
51	30B	1	.052	.03	ASSM. KEY BEARING & SHAFT
51	30C	1	.052	.02	ASSM. KEY BEARING SPACER & SHAFT
51	30D	1	.085	.02	ASSM. BEARINGS TO DOUBLE GEAR
51	30E	1	.043	.03	ASSM. SPACER BRGS. & KEY
51	30F	2	.074	.05	ASSM. SHAFT SPACER & BEARINGS
51	40A	1	.364	.20	ASSM. SWITCH TO HOUSING
51	40B	1	.659	.21	ASSM. SHAFTS IN HOUSING
50	50	1	.098	.10	ASSM. KNOBS TO COVER
50	60	1	.090	.20	ASSM. SHAFT GEAR SPACER BRG. ETC.

Fig. 2—Traveler envelope contains brief instructions to the Assembly Dept on the jobs to be assembled. On the face of this manila envelope are reproduced descriptions of each operation, as well as standard allowed times for the operations. Inside the envelope go an operation sheet (similar to the envelope) and copies of the parts lists for the operation. Parts list for Operation 10A is reproduced below

MFG. ORDER NO. 11

PART NO. M-3204

UNIT & LOT NO.

NO. OF PARTS

NAME: NO. 2 AC FEED & THREADING TRANSM. WITH FIVE HYDRAULIC CLUTCHES ETC.

NO. OF SHEETS 17 — SHEET NO. 1 — PREPARED BY RCP:HR — DATE 5-21-58 — REVISED

USE

QUANTITY REQD.	QUANTITY FILLED	UNIT REQ.	PART NUMBER	PROD. POST	PART NAME	LOCATION				★ USED WITH M
					OPERATION 10A					
		1 X	580-1063	R	PIN	14	7	7	4A	
		1 Y	3204-58		GLAND BUSHING	113	1	5	2	
		1 Y	3204-57		GLAND FLANGE	111	2	2	1	
		1 X	3204-35		END CAP	116	4	6	3	
		1 X	3204-1062		END CAP GASKET	117	7	8	1A	
		3 X	8821-1040	R	1/4-20 X 3/4 HEX. SOC. HD CAP SCREW	27	13	3	1	
		3 X	8855-1105	R	1/4 X .047 X .078 HI-C SPRING LOCKWASHER	10	4	3	3	
		3 X	8859-1023		3/16 X 1-1/4 X 1 1/2 "O" RING	10	13	4	2	

Fig. 3—Assembly parts lists shows the parts needed for each operation. It furnishes the stockroom with information on parts that the Assembly Dept will require, also tells the Assembly Dept what parts go into each operation. For every operation on the traveler envelope (above, top) there is one of these parts lists

consult these cards to get step-by-step instructions on each operation. (NOTE: Fig. 2 shows the face of the traveler envelope. In Fig. 3 a materials parts list is reproduced.)

Releasing the traveler

From Standards, the traveler envelope goes to the Traveler Release section of Production Scheduling, which takes the parts list and expands it by the quantity of units to be assembled. This section also prepares for each part a tag that shows such information as the part number and the machine number.

Now the traveler envelope, as well as one parts list, goes to Assembly, where it serves as a directive to the foremen who will be in charge of the actual assembly operation.

The second parts list and the tags go to the stockroom. Here the actual parts for the assembly operations are pulled from inventory, tagged, and boxed for shipment to the assembly line. The checked-off parts list then goes to a posting clerk in Production Scheduling, who thereby is informed that all parts for the assembly operations are available in the stockroom.

Assembling units

When the schedule calls for a particular assembly job, all paperwork instructions are on hand in the assembly shop. At the same time, the parts that will be assembled have been forwarded from the stockroom to the shop.

The assembly operator begins his job by studying the setup card for the operation assigned him by his foreman. (Setup cards, it will be remembered, had been forwarded from the Standards Dept in advance of the traveler envelope—see No. 13 on the schematic.)

The assembly setup card contains, on one side, a description of the operation and all special and standard tools and fixtures required for the operation. On the back of this card appear step-by-step instructions, which the assembler follows to complete the operation. When the operator is finished, the foreman notifies the assembler of the next operation on which he will work. This process continues until all assembly operations have been accomplished.

Once a unit is assembled, the traveler envelope goes back to Production Scheduling, which clears the assembly operation off its records. Later the envelope is relayed to Cost Accounting, which extracts information and then destroys it.

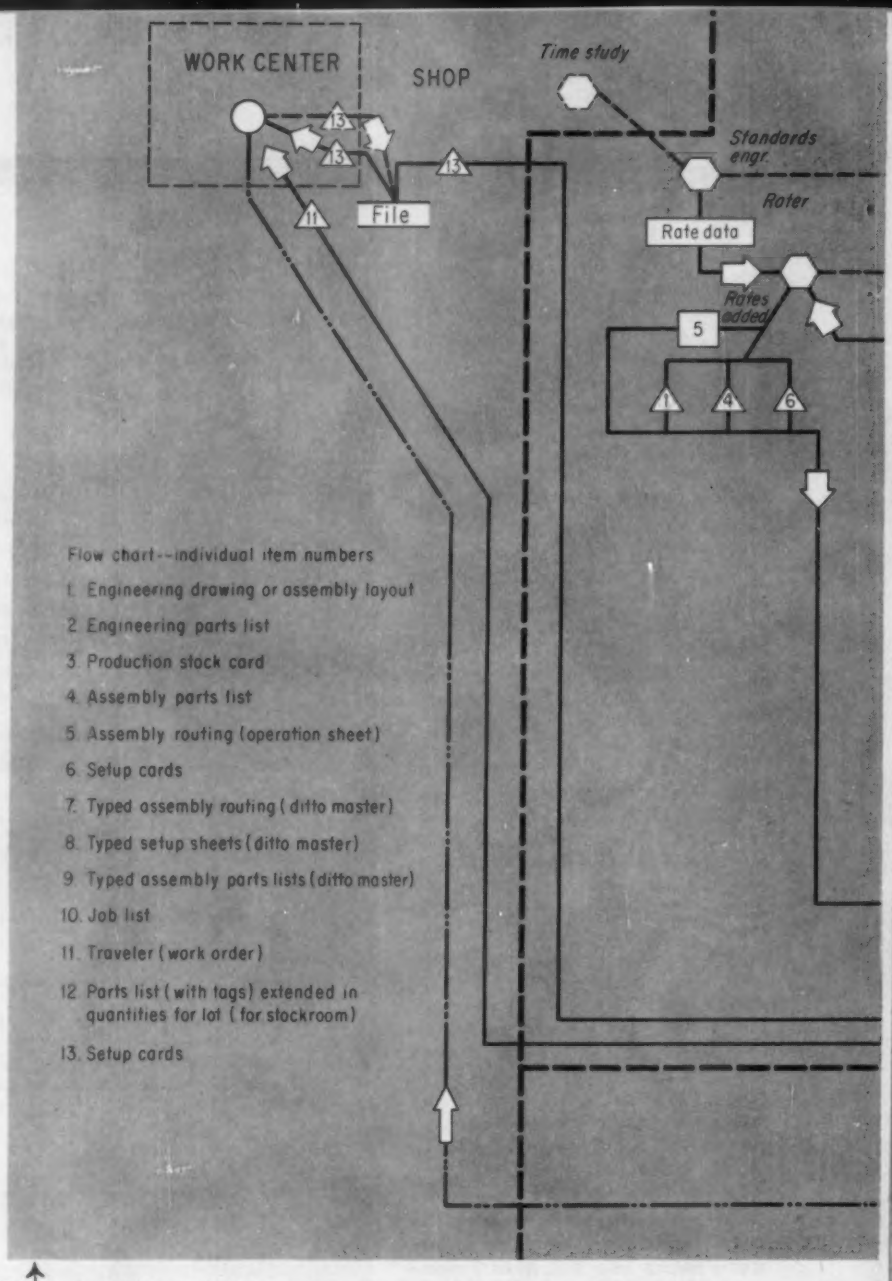


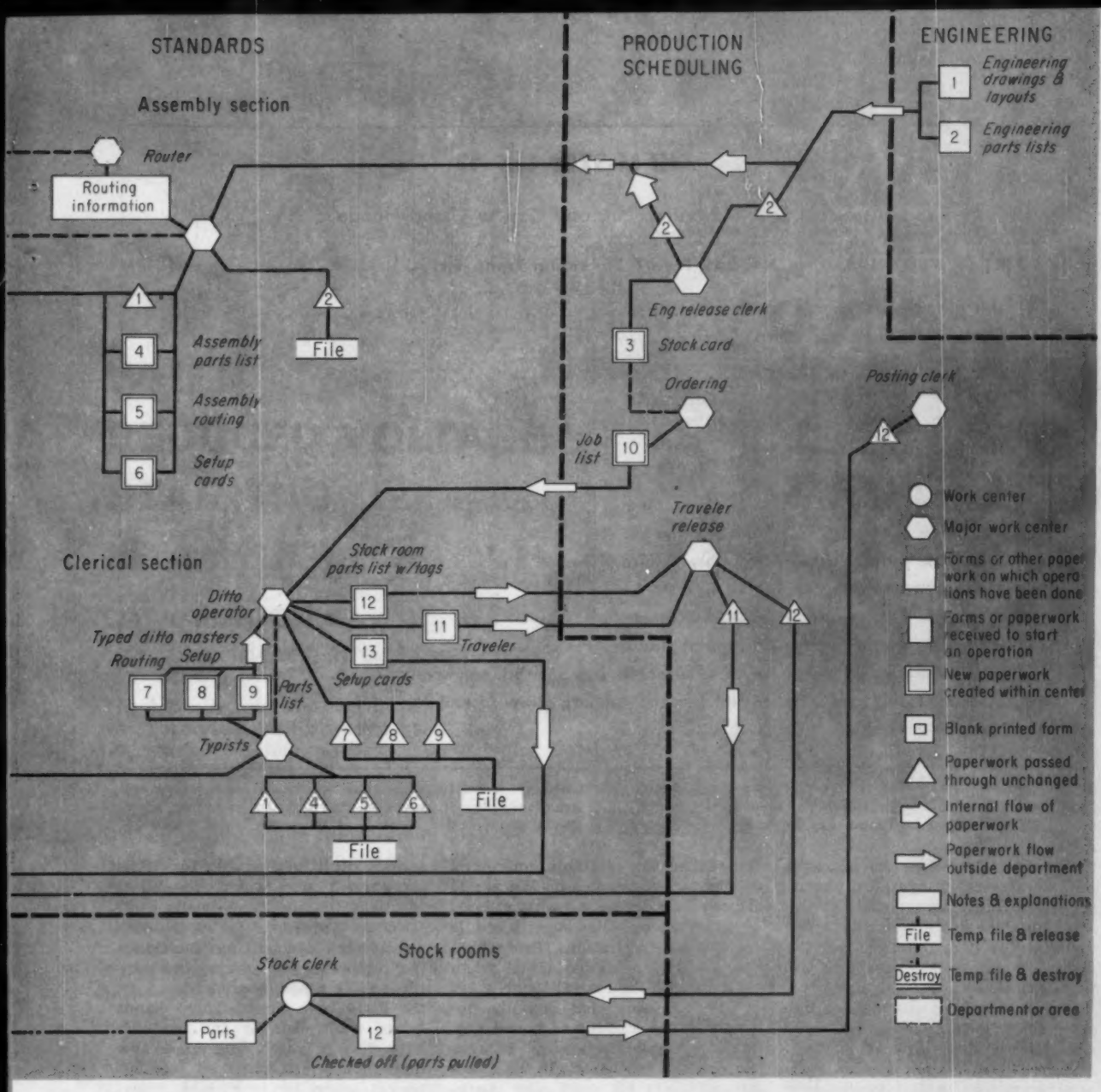
Fig. 4—Assembly schedule shows flow of paperwork and parts to the assembly shop. See text of this story for detailed descriptions of what happens in each of the departments shown on this schematic

Fig. 5—Daily time ticket is filled out by a centrally located timekeeper. When an assembly operator starts and finishes an operation, he phones in data to the timekeeper, who records the operator's performance. Actual hours, compared with standard hours, determine the amount of incentive bonus

Calculating incentive bonuses

Because the plant has so consistently standardized its assembly work, Warner & Swasey is in a beautiful position to reward work that exceeds the norm. Calculating incentives is simply a matter of comparing actual performance with standards already set up. In the Assembly Dept, every worker has the opportunity, where a standard has been developed, to earn bonus pay in addition to his regular hourly rate.

Here is the way performance is



SHIFT 1	HOME DEPT NO. 52	DATE 1-12-60	MAN NO. 5432	NAME SMITH							
MFG. ORDER NO.	PART NO.	X-ORDER	OP NO CODE	CYCLE	SET UP	PIECES PASSED	STD. HRS.	ACT. HRS.	CODE	A TIMED HRS. B DAY WORK HRS. C LOST TIME HRS. D EXCESS WORK HRS.	
11-123423	M-3204		80								
SALES ORDER	SHOP TOOL ORDER	CHG. DEP. / ACCOUNT NO.		1.535	.60	2	3.7	3.5	A	8.0	
		42 01 10								4.5	
MFG. ORDER NO.	PART NO.	X-ORDER	70B								
	M-3204							1.5	D		
SALES ORDER	SHOP TOOL ORDER	CHG. DEP. / ACCOUNT NO.	32							3.0	
Repair		39 42 01 30									
MFG. ORDER NO.	PART NO.	X-ORDER	70B								
11-123432	M-3204			.617	.25	6	4.0	3.0	A		
SALES ORDER	SHOP TOOL ORDER	CHG. DEP. / ACCOUNT NO.								0.0	
		42 01 10									

WARNER & SWASEY DAILY TIME TICKET	STD. HRS.	ACT. HRS.	D.W. HRS.	L.T. HRS.	EXC. WRK. HRS.	NET EFF. %	PAY EFF. %	BONUS HRS.	TOTAL HRS.	EXTD. BY
	7.7	6.5			1.5	118%	124%	1.6	8.0	WG

Use until M-3200 Lot 42

Assemble Gland Bushing, Pin, and Cap to Gland Flange

M-3204 OP. 10A No. 2AC Feed & Threading Trans. Etc.

1.	Get gland bushing and wash	1
2.	Get gland flange and clean	1
	Burr 9/32 holes	3
	Burr ¼-20 tapped holes	3
	Burr No. 5 drilled hole	1
3.	Get end cap and wash	1
	Burr edges of end cap	1
	Burr 9/32 holes	3
4.	Assemble "O" rings to gland bushing	3
5.	Assemble gland bushing assembly to gland flange	1
6.	Drive pin into end cap	1
7.	Assemble & align gasket to gland flange	1
8.	Assemble & align end cap to gland flange	1
9.	Assemble spring lockwasher to ¼-20 x ¾ lb. hex soc. hd. cap screw	3
10.	Assemble and bind ¼-20 x ¾ lb. hex soc. hd. cap screw to end cap	3
11.	Assembly aside	1

Fig. 6—Assembly setup card is kept on file in the Assembly Dept. Assembler gets each operation number from the foreman, then pulls setup card from the file to get step-by-step assembly instructions. Section reproduced here shows instructions only. Other side of card describes operation, shows special tools needed, as well as inspection instructions

recorded: Just before he starts a job, the assembly operator phones a central timekeeping office, giving his name, the manufacturing order number, the part number, and the operation number. Timekeeping enters this information — and other figures, including standard time rates for the operation—on a daily time ticket (see Fig. 5). When the operation is completed, the assembler phones in data for the next operation. At the same time, he gives the quantity completed on the old job. The timekeeper, who has carefully punched the time clock at each telephone call, can easily calculate actual hours expended on the operation.

Thus for each operation the timekeeper has, on the time ticket, a comparison of actual vs standard performance. Dividing standard hours by actual hours gives the net efficiency of the assembly operator. Actually, this net efficiency doesn't determine the amount of bonus payment. The company realizes that assembly work by nature tends to be less efficient than many other types of work. Such unavoidable delays as those caused by involved inspection, and long waits for cranes, necessarily reduce an assembly operator's efficiency. For this reason Warner & Swasey has developed what it calls a minor delay allowance schedule for assembly operations. This schedule, actually a simple table, when entered with the net efficiency, gives a pay efficiency that actually determines the amount of bonus pay. In this table, assembly bonuses start at 70% efficiency. (In the incentive program for machining operations, on the other hand, bonuses start at 85% efficiency.)

To keep an assembly worker from being penalized because of conditions beyond his control, work entered on the time ticket is divided into four categories:

(A) Timed hours (covers those operations for which standards have been set)

(B) Day-work hours (for those operations not covered by standards)

(C) Lost-time hours (due to unavoidable delays)

(D) Excess-work hours (time to perform work that is not part of the standard job—repair, maintenance, etc)

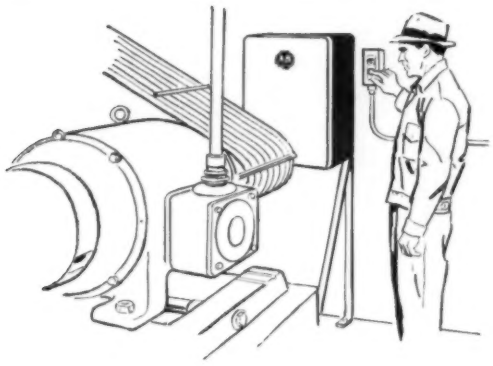
By differentiating between each of these types of work, the company can segregate the timed hours of actual work performed, for it is these timed hours which are used to calculate the incentive bonus.

To get the bonus hours that the worker has earned, one multiplies the pay efficiency (minus 100%) by the actual timed hours entered on the daily time ticket. These bonus hours, multiplied by the worker's base hourly rate, determine how much extra cash will go into his pocket when he receives his next paycheck.

One of the keys to a successful program of assembly incentives, in the opinion of Peter Rusnov (chief industrial engineer) is in recognizing that there will be a "maintenance problem" and in being prepared to handle it. The system must keep pace with engineering design changes and with new-design machines, or it will disintegrate. An out-of-date program makes job rates too loose and too sloppy, and workers are likely to lose confidence in the system.

Rusnov points out, "A substantial portion of the time spent by the Standards Department on assembly standards goes into keeping the operations already on standards up to date."

CIRCLE 249 READER SERVICE CARD ►



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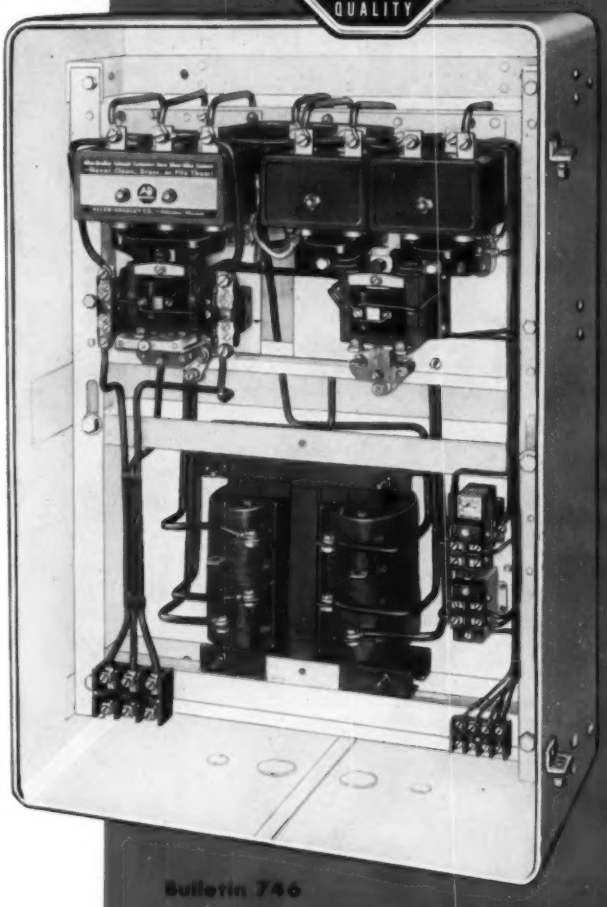
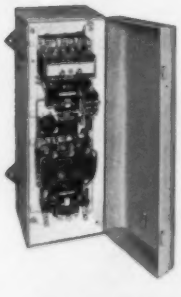
A-B QUALITY



Bulletin 746

Automatic reduced voltage starter for squirrel cage motors that should not be started on full line voltage. It employs autotransformer connected in open delta to reduce line voltage during starting. Adjustable timing relay controls starting period. Taps are provided on the autotransformer to adjust the starting voltage applied to the motor. Ratings to 300 hp, 220 v; 600 hp, 440-550 v.

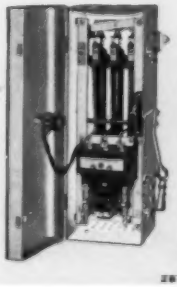


Bulletin 740

Graphite disc resistors are automatically inserted in series with the squirrel cage motor at starting, and they are automatically cut out after a predetermined time. Turning a single screw on the starter frame adjusts the compression resistors exactly to motor and load conditions for velvet smooth acceleration. Ratings to 200 hp, 220-440-550 v.

Bulletin 640

Where remote control is not needed, these graphite compression disc resistor starters provide stepless acceleration of squirrel cage motors. Operated by hand lever, the smooth starting of the motor is under the control of the operator. No-voltage and dependable overload protection is provided. Ratings to 200 hp, 220-440-550 v.



28-60-R

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• RELIABLE OVERLOAD PROTECTION
All A-B starters are equipped with two permanently accurate and reliable overload relays that protect motors against "burnouts." Three overload relays can be furnished.

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BULLETIN 709 SIZE 7 with maximum ratings of 300 hp, 220 v; 600 hp, 440-550 v.

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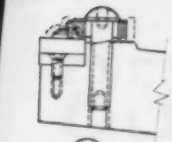
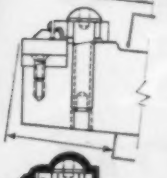
THAT'S WHAT YOU GET WITH THE VALENITE THROWAWAY INSERT HOLDER . . . AND HERE'S WHY:

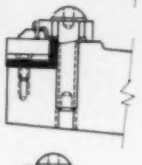


Fully adjustable chipbreaker for complete chip control—A Valenite first, with five year record of dependable on-the-job performance.

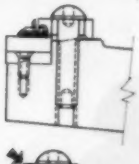


Shortest overhang—More tool in the tool post means greater rigidity.

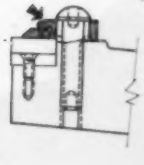
Lowest profile—Insures maximum chip clearance even in close quarters.



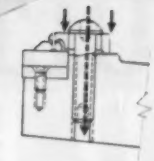
More accurate pocket—Special machining to rigid quality standards guarantees full insert support and fast, accurate indexing.



Area clamping contact, chipbreaker-to-insert—Prevents breakage from chip wedging, minimizes insert stress.



Lock-pinned chipbreaker—Stays with clamp when changing or indexing inserts, yet is fully replaceable.



Convenient, damage-proof clamp screw—Axial, straight line load design prevents clamp screw damage. Clamp screw is adjustable from top or bottom.

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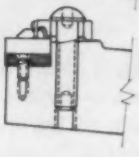

Carbide shim seats in three thicknesses—Provide insert cost saving.

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Large field service organization—Provides immediate delivery from stock in most areas, and competent service from experienced field engineers on any application, large or small.

The Valenite Holder is ready right now with time and job proven advantages for faster, more trouble-free production — a better product at less cost.

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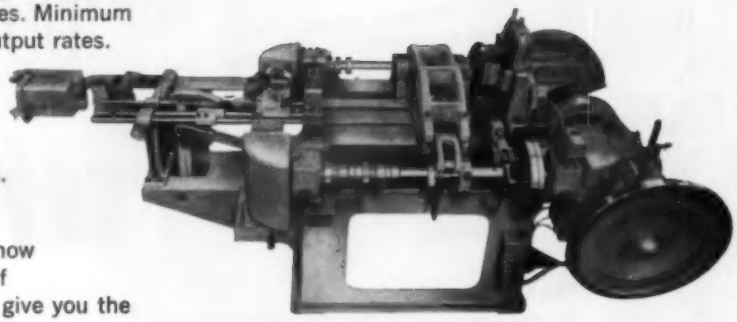

U. S. Multi-Slide #33

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MULTI-SLIDE

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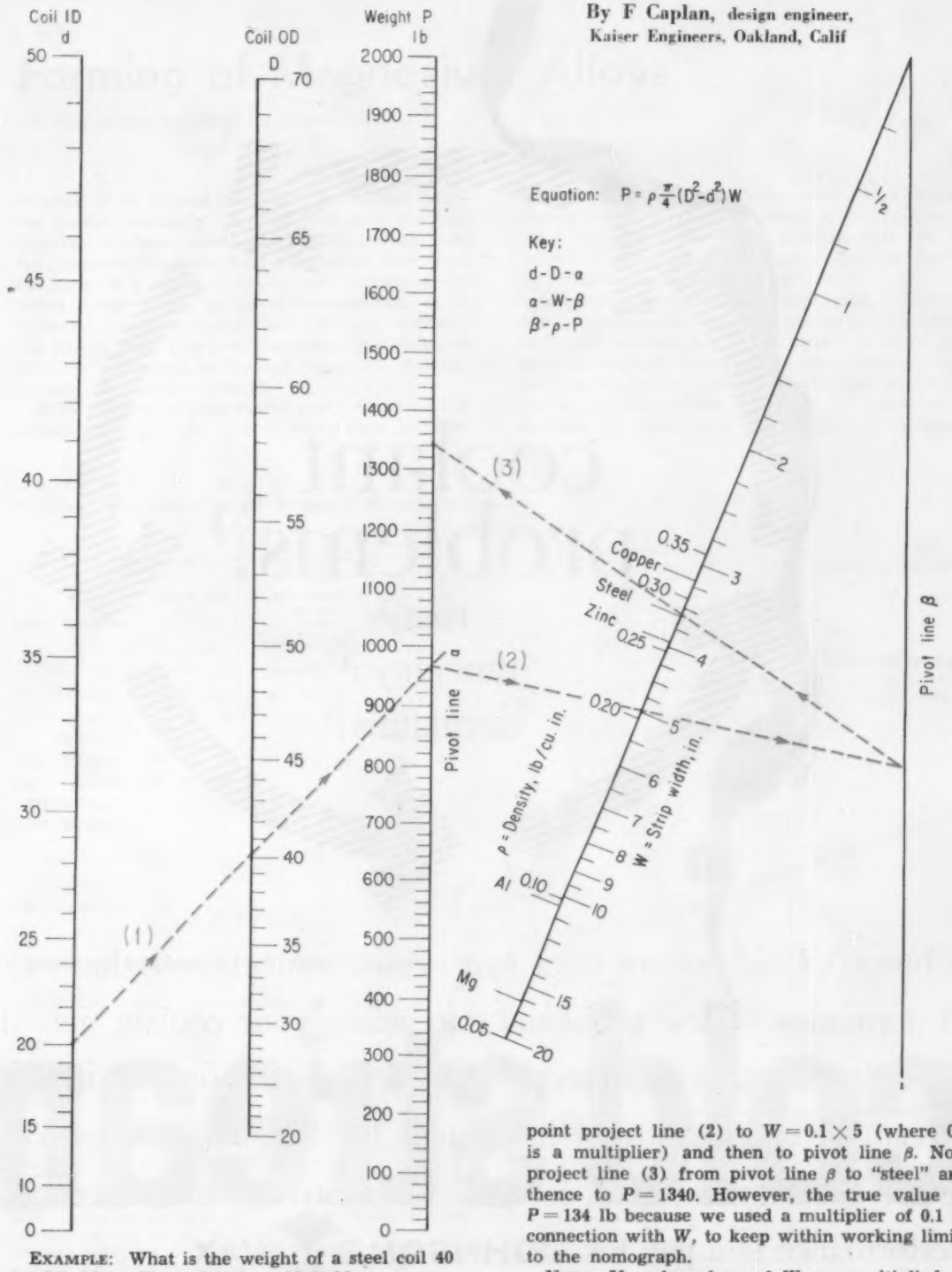
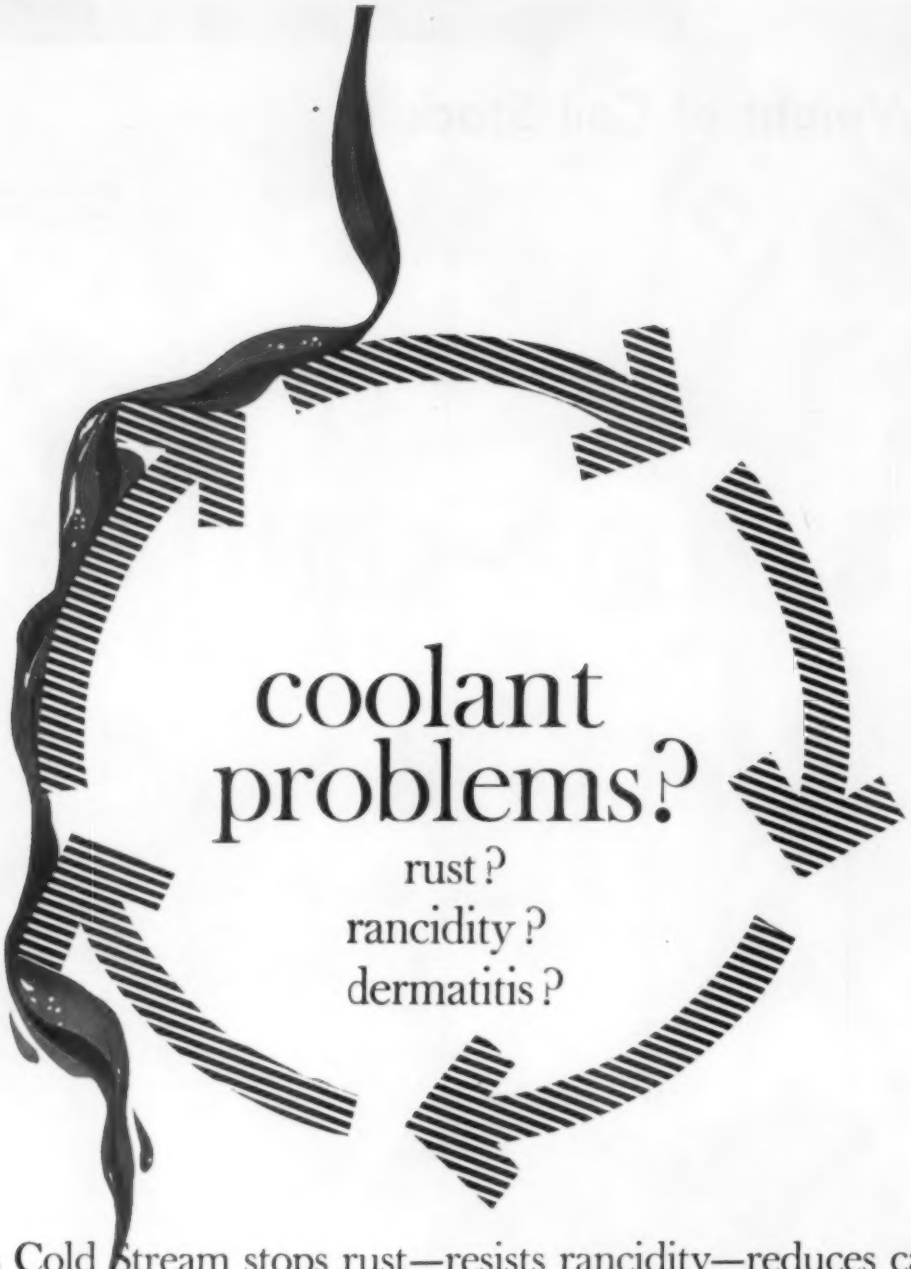
Weight of Coil Stock

By F Caplan, design engineer,
Kaiser Engineers, Oakland, Calif



EXAMPLE: What is the weight of a steel coil 40 in. OD, 20 in. ID, and ½ in. wide? Move on construction line (1) from 20 in. ID to 40 in. OD and thence to intersection on pivot line α. From this point project line (2) to $W = 0.1 \times 5$ (where 0.1 is a multiplier) and then to pivot line β. Now project line (3) from pivot line β to "steel" and thence to $P = 1340$. However, the true value of $P = 134$ lb because we used a multiplier of 0.1 in connection with W, to keep within working limits to the nomograph.

NOTE: If scale values of W are multiplied or divided by 10, then scale values of P must likewise be multiplied or divided by 10.



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Forming of Magnesium Alloys

Courtesy: Brooks & Perkins, Inc, Detroit, Mich

Magnesium is formed hot (350-650 F). Hot forming makes necessary the use of a heat-resistant drawing lubricant such as graphite, rather than the common petroleum-base compounds. Dies must be made of a material which will withstand the above temperature. In operations requiring much pressure, the die material must be creep resistant. Die design must take into consideration differences between coefficients of thermal expansion of magnesium and the die material.

However, hot forming makes possible much more complicated and more severe draws than are possible in one operation with most other metals. Springback is never a problem. With hot, single-draw operations no intermediate anneals are required. The diagrams show suggested design factors for deep-drawn magnesium parts.

In addition to normal rectangular box, cylindrical and hemisphere draws, it is possible to incorporate embossed stiffener ribs in the draw die. These will produce a ribbed drawn part without secondary operations. Magnesium sheet is readily formed by the Guerin process (rubber forming), by stretch press forming, by press brake forming and by spinning.

Forming Characteristics of Wrought Magnesium Alloys

Alloy	Condition	Approx. Min. Radius (90° Bend)			Max. Reduction per Draw Percent			Best Temp. for Hot Working ± 50°F	Hot Shortness Begins, F
		70°F	400°F	600°F	70°F	400°F	600°F		
M1	Annealed	5t	3t	2t	20	30	50	600	850
M1	Hard rolled	12t	5t	2t				400	850
M1	Extruded							600	850
AZ31	Annealed	4t	3t	2t	20	30	50	500	800
AZ31	Hard rolled	12t	4t	2t				350	800
AZ31	Extruded							500	800
AZ80	Extruded							500	750

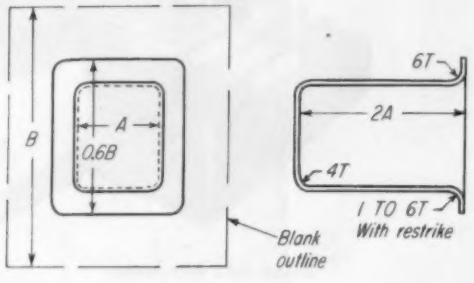
$$\text{Percent reduction} = \frac{\text{Blank Diameter}}{\text{Blank Diameter}} \times 100$$

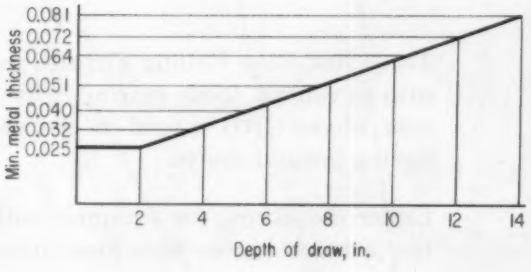
Minimum Radiuses for 90° Bends in Tubing*

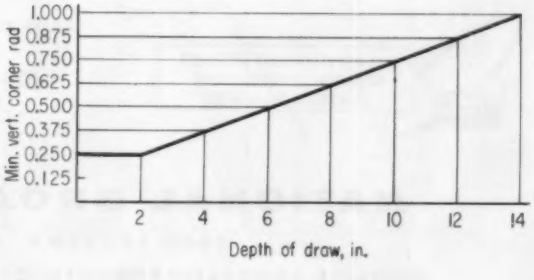
Alloys	70°F	400°F	600°F
M1 AZ31 AZ80	4D	2D	1½D

Values for minimum bend radius apply to 0.040 to 0.072 in. thickness; they decrease for thinner gages and increase for thicker gages. Smaller bend radii can be successfully used when bends are with the grain rather than across the grain. Tube-bend minimum radii will vary with diameter of tube and thickness of tube wall

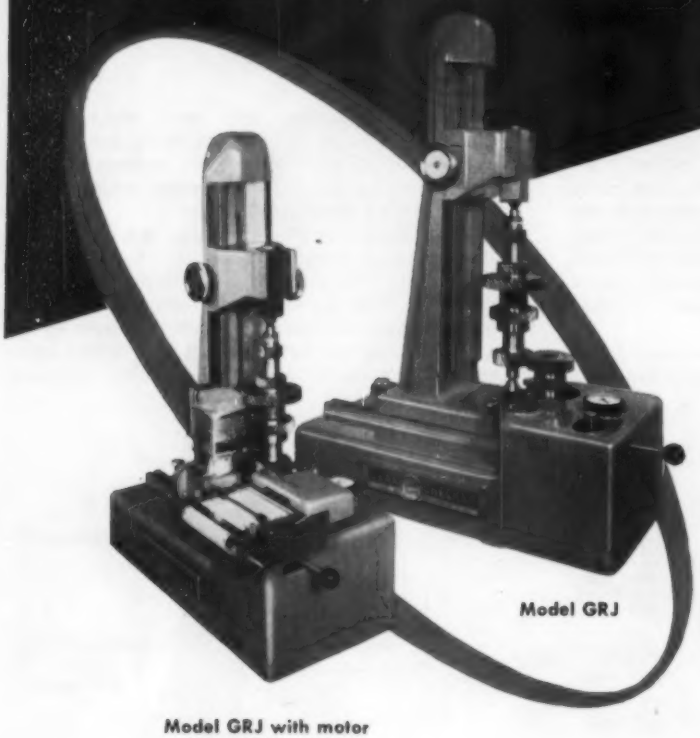
*Radius measured to center of tube, and given in multiples of tube diameter D.







NEW RED RING Gear Rolling Fixtures



Model GRJ

Model GRJ with motor drive and recorder

Model GRH with motor drive

These Red Ring Rolling Fixtures furnish a quick composite check of gear errors such as runout, tooth spacing, tooth profile, helix angle and tooth surface roughness. Model GRH is used for flat gears, Model GRJ for either flat gears or those having integral shafts.

Either model may be equipped with a constant-speed motor drive to eliminate the factor of non-uniform manual operation.

The motorized fixtures may also be equipped with a tape recorder for permanent inspection records.

For further information ask for Bulletin C 60-8

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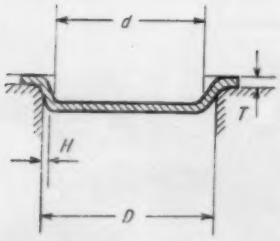
Clearance for Cupping Dies

By Ferenc J Kuchta, mechanical engineer, J Wiss & Sons Co, Newark, N J



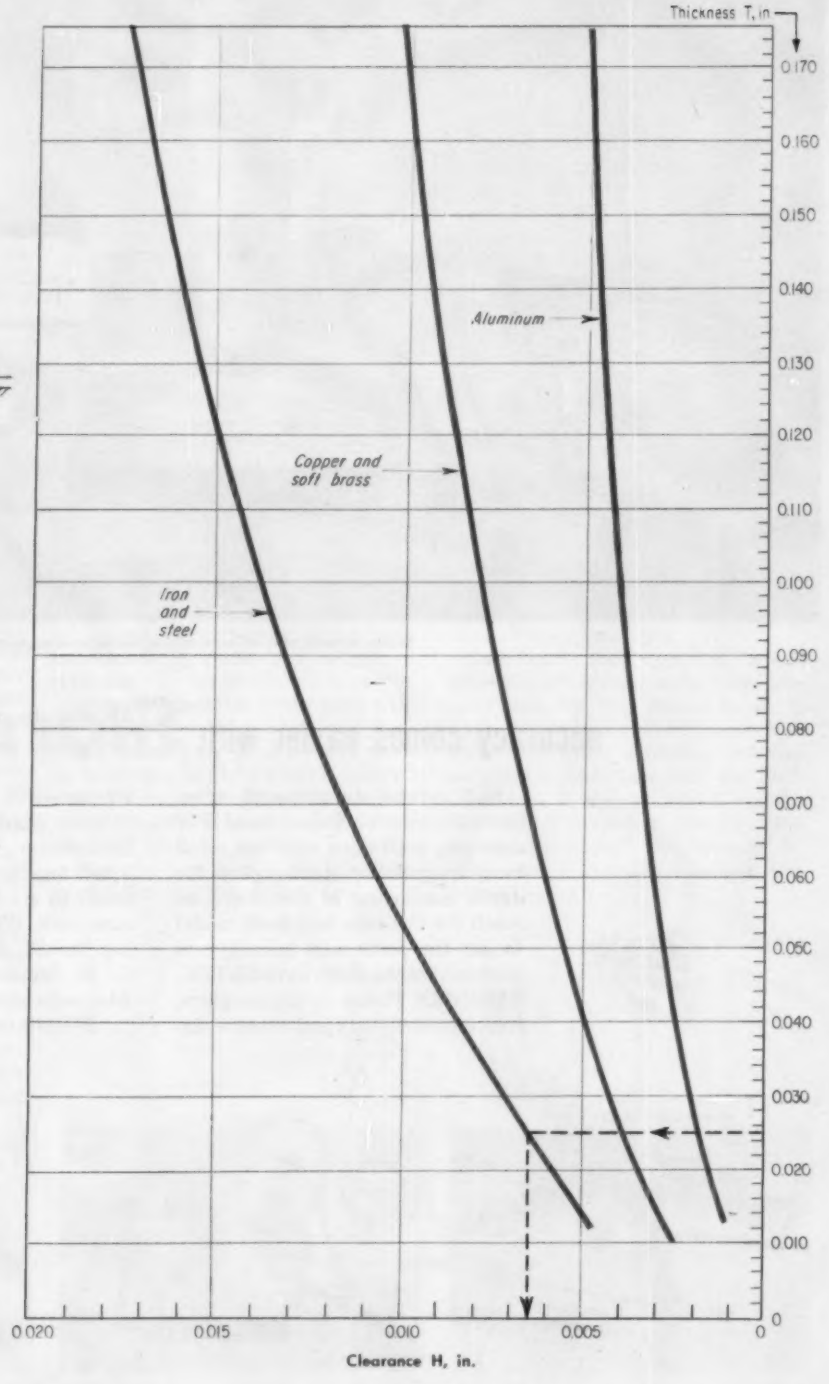
$D = d + 2H + 2T$

where:

D = die dia, in.
d = punch dia, in.
T = blank thickness, in.
H = clearance *per side*, in.

Example:

$d = 1.00$
$T = 0.025$ iron sheet
$H = 0.0065$ (from nomogram)
$D = 1.00 + (2 \times 0.0065 + (2 \times 0.025) = 1.063$ in.



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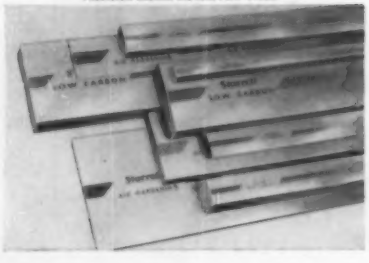
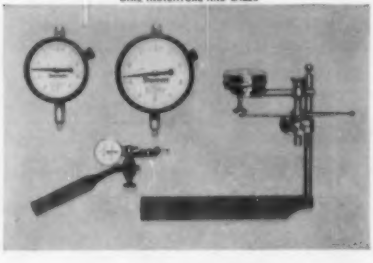
World's Greatest Toolmakers

PRECISION GROUND DIE AND FLAT STOCK



DIAL INDICATORS AND GAGES



HACKSAWS, HOLE SAWS, BAND SAWS, BAND KNIVES

Talking Shop

Controversial Countdown

"ON THE NIGHT of October 30 we fired a routine Jupiter A—a Redstone missile with Jupiter experiments aboard. But in this case somebody goofed. . . . Two connections which should have been thoroughly soldered down were not well fastened. Just after the missile lifted from the launch pad, the vibration of the tremendous engine separated these two small wires from their connections. As a result, the missile went completely out of control. At about 200 or 300 feet in the air it flattened out and started right down the Cape in the direction of the Thor launch pad. . . . The Range Safety Officer blew it up."

In telling this particular incident, General John B. Medaris imparts one of the few humorous touches in his history of missile development in the U S Army.* At that time the Army and the Air Force were already engaged in the struggle for existence between the Thor and the Jupiter. "We were accused of having a very inaccurate missile since we had found it impossible, even at that short range, to hit the Thor launch pad. . . . This particular failure became known as the IPM—the Inter-Pad Missile."

Inside View

The example above is about the only specific discussion of a manufacturing failure in all of Gen Medaris' inside view of one part of our missile program.

In the chapter "Biography of A Missile," Medaris gives an unusually lucid description of the trial and error process by which a missile develops. But his concern is primarily with the administrative jungle in which missile development takes place. Hardly anyone escapes his wrath. Some of his stronger charges:

"The lack of a sound, experienced, military-technical organization in the Air Force has been responsible for the technical side of that Service becoming almost a slave of the aircraft and associated industries."

"At the Joint Chief's level, we have probably had the least effective military organization to haunt the United States since the fiascos of the Civil War."

"Our present military operations are governed by a committee with widely divergent views. There is no example in history of military command being exercised under those circumstances."

"There are times when I am convinced that the Pentagon itself, as a building, is responsible for many of the problems and inefficiencies in the military services today."

Inevitable Condition

An inside view is bound to be biased, and Medaris makes no secret of his. He is rather good at seeming to be objective at times, but at others he seems to be writing in an almost blind rage.

Some weaknesses in his arguments are glossed over, but more uncomfortable and unpopular facts and arguments are presented than are usually found in the reminiscences of retired military men. It is a book calculated to make you angry — whether you agree with him or not.

Because we think every man with a direct interest in our missile program—or any aspect of it—will want to read this book, we have delayed telling some of the bits of shop lore that normally fill this page, to devote so much space to it.

Medaris does something less than justice for the many dedicated people in other parts of the missile business, but he tells one painful story that almost everyone can read with sympathy and understanding: the administrative tangle behind our first satellites.

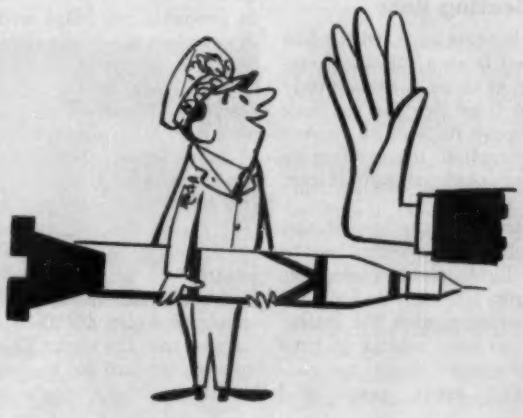
A Year's Delay

On the night of September 20, 1956, Missile 27 was fired from Cape Canaveral. "If we had put a solid propellant into the fourth stage instead of the inert material we were using to get to the right weight, we could have fired that particular missile into orbit as a satellite. . . . We didn't do this for the simple reason that we were forbidden to do so. . . . The firing itself was uneventful."

Two missiles had been prepared for this shot—No. 27 and No. 29. "We had not needed Missile No. 29, so we put it back on the shelf with hope in our hearts that some day we might be able to use it as a satellite."

More than a year later the soon-to-take-office defense secretary, Neil McElroy, was scheduled for a 24-hour orientation visit to Redstone Arsenal. When Sputnik went off during this period, the Redstone group promised a satellite shot within 90 days of the green light.

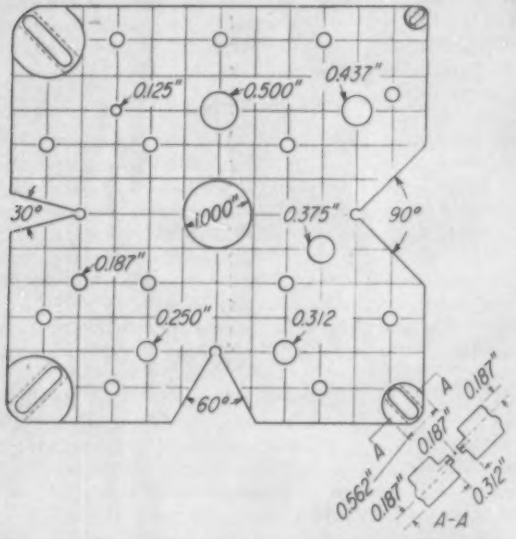
Convinced the approval would come almost immediately, Gen Medaris told Dr Von Braun to go to work. The approval didn't come. Medaris was soon directing an unauthorized crash program. On Nov. 3, Sputnik II was launched. On the 8th day of November, the directive was finally issued. On January 31, 1958, Missile No. 29 launched Explorer I.—AA



*Countdown for Decision. By Major General John B Medaris, U S Army, retired, with Arthur Gordon. Published by G P Putnam's Sons, New York. 303 pages. Price $5.

Practical Ideas

Work Plate—A Great Aid in Prototype Work



When used as a piercing or notching die in a kick press, or on the filing machine to produce accurately radiused corners, this plate can be a big time saver.

It provides six hole sizes: 0.125, 0.187, 0.250, 0.312, 0.375, and 0.500 in. each one relieved allowing about 0.062-in. top-sheer edge. Three V-cuts for punching cutouts and notches of various angles are machined into the edges of the plate.

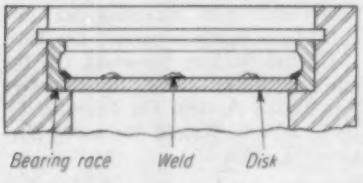
For repetitive notching or piercing work in small lots—ten to fifty pieces—uniformity is insured by butting the work against parallels clamped to the plate's surface. These are secured in the 10-32 tapped holes provided throughout the plate and, if these don't suffice, others may be added before plate is hardened. The lines engraved on the plate are to simplify locating parallels and work to be profiled.

Each corner is milled to accept its individual set of radius buttons. These are placed and secured so they are tangent to adjacent edges. Their purpose is to aid the operator in producing a perfect radius on a templet or prototype part in the filing machine.

All buttons are 3/16 in. thick and are, to some extent, interchangeable. However, the upper right-hand corner is designed to take buttons with diameters: 0.125, 0.187, and 0.250 in.; lower right takes: 0.312, 0.375, 0.437, and 0.500 in. In lower left-hand corner goes diameters: 0.562, 0.625, 0.687, and 0.750 in.; in upper left: 0.812, 0.875, 0.937, and 1.000 in. All but the smallest set of buttons are secured by 10-32 capscrews inserted from the bottom. The small ones are held in place with 1-72 screws.

The material for the plate can be either oil or water-hardened ground stock, outer dimensions being 6 x 6 in. and the thickness finish ground to ½ in. Machining is performed as described, but the guide lines must not run into the piercing holes as they will produce nicks in the work if they do. Upon completion, the plate is hardened, drawn, and ground all over. The buttons are made of drill rod which, after marking, are hardened to RH 58C or better.

Henry Piltz, East Orange, NJ



Welded-In Disk Removes Bearing Race

A worn out bearing race, which had to be removed from a tubular housing, recently gave us a disassembly problem. We tried heating the race so it would break its hold by expansion and contraction, there being no way to either push or pull it out, but without success.

We then struck on the idea shown in the sketch. After cutting out a disk from light steel plate, we dropped it into the race and placed a few tack welds around the inside. It was next an easy matter to turn the housing upside down on parallels in the arbor press and push the bearing out of the bore.

George R Mahnken, Ramsey, NJ

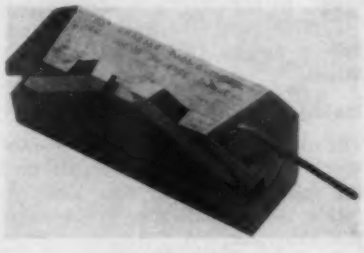
Jig Speeds Tool Grinding

Does grinding a perfect thread-chasing tool appear as a problem to you? If your method of grinding the angles is by freehand, your answer is probably yes. But why do it this way when a simple jig block will produce an accurate tool in less time.

The block shown is a simplified version of more elaborate ones—it will only take minutes to make—and is fully as serviceable and reliable. As a project, it's an easy shaper job.

After two slots have been cut at 30° across the corners of a rectangular block, (size of slots to suit the toolbits to be ground) the corners are knocked off, also at 30°. Two setscrew holes are then drilled and tapped into the slots. This takes care of the standard 60° tool angle.

The clearance angle is produced

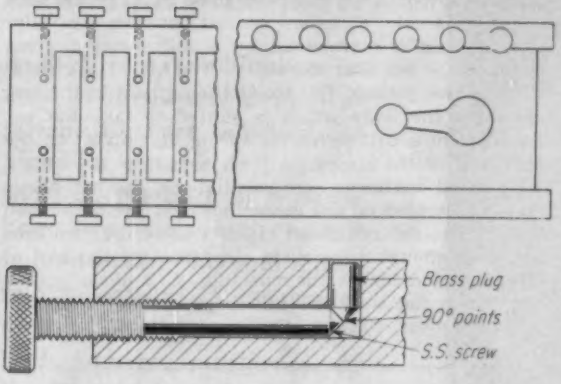


by leaning the block forward. To do this, the block is tilted 8° in the shaper vise and the bottom faced off. The top side is also faced at the same angle to make both sides parallel to each other.

To save time and grinder wheel it's a good idea to first rough grind the bit as close to the intended shape as possible. This is particularly advisable when you're starting with a fresh blank. Any small surface grinder with a magnetic chuck can now be used to finish the tool.

Raymond A Morris Sr, Pittsburgh,

Magnetism Breakers Eliminate Scratched Work



Thin, soft, iron plates, set on the magnetic chuck of our surface grinder, recently gave us a bit of trouble when we had to remove them from the chuck. This was the result of the pieces being partially magnetized as the chuck was a permanent-magnet type and could not be reversed. Wringing or pulling them off was the only way to remove them, but this produced scratches on the mounting face which, the specification said, could not be tolerated.

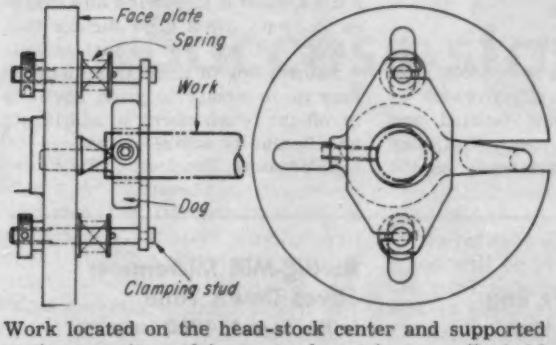
To prevent scratches, it would be necessary to lift the work, all or partially, straight up. This I accomplished with the magnetism breakers shown.

Horizontal holes were drilled into the edge of the chuck about ⅝ in. from the top face. These were joined by holes drilled from the top at the desired locations. The vertical holes were then fitted with brass plugs to rest below the chuck's surface and with 90° points at the bottom. Stainless-steel screws, with similarly pointed ends inserted in the horizontal holes, raised the brass plugs when tightened.

Thus, once the magnetic grip has been broken it's an easy matter to pick off each piece unscratched.

John Roger, Melbourne, Australia

Hold-Back Secures Work for Steadyrest Turning



Work located on the head-stock center and supported at the opposite end by a steadyrest is generally held in contact with the center by some improvised method like belt lacing tied around face plate and driving dog. Not only does this top everything makeshift, but it is most often unreliable and therefore risky.

An easier and more dependable method, especially when doing repetitive work, is illustrated. It is a hold-back fixture which is easy to make, and its use saves considerable time and bother.

The major portion, of which a few can be made to suit several work diameters, is a plate drilled through its center to clear the work. Slots in the ends slip over flats milled on a pair of clamping studs.

A light spring and two washers are assembled under a pin on each stud for keeping them in position when the plate is removed. Knurled nuts, placed on washers when necessary, pull the plate and work uniformly against the center. Pin holes, drilled in the nuts, are used for getting additional pressure in cases where the direction of the cut is away from the center.

M W Loftus, Chicago, Ill

Cup Center Speeds Center Drilling Long Bars

Center drilling large quantities of long bars in the lathe is a cumbersome job unless special provisions are made. This doesn't mean that elaborate tooling is necessary; on the contrary, simplicity can be the keynote as proved by the illustrated setup.

Here, a cup center is made from a scrap piece, gripped in the lathe chuck, to center and drive the work. For support at the extended end, the steadyrest with its top half removed

is clamped to the lathe bed. The two remaining steadyrest jaws are then adjusted to locate the work on the center of the lathe axis.

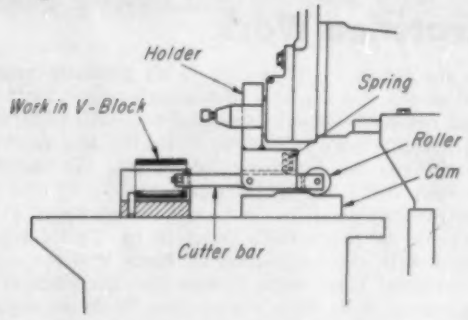
With a combination center drill mounted in the tailstock, the work loading, drilling, and unloading operations can now proceed in rapid succession. The operator with his left hand seats the work in the cup center while resting the bar on the steadyrest jaws. Frictional contact drives the work as the tailstock quill is advanced to feed the drill into the work.

Our operator has developed such a technique that the lathe runs continuously; he merely inserts one bar after another in rapid sequence.

H J Gerber, Stillwater, Okla

Practical Ideas

Shaper Cuts Oil Grooves

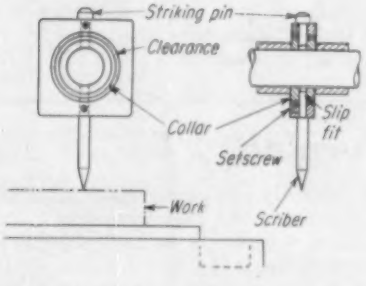


With all regular oil-grooving equipment tied up, a shaper was tooled up as shown for cutting oil grooves in a production run of bronze bushings. The grooves were simple round-bottom reservoirs cut in a straight line beginning and ending just inside the ends of the bushing.

The tooling consists of a pivoting cutting bar having a grooving tool in the front end and a roller in the back riding on a cam. Constant contact between the roller and the cam is maintained by a stiff spring bearing down on the bar near the roller. The holder is a weldment of two pieces. The shank, being held in the tool post, and the body which is slotted to take the bar are blind-hole drilled for the spring. Bar pivots on the front end of the holder.

To avoid confusing cam calculations, the bar pivots on a pin located on the center between the cutter and roller. The flat reliefs on either end of the cam lobe are deep enough to provide clearance for the tool as it enters and leaves the bushing. A V-block with a stop holds the work on the shaper table.

M W Loftus, Chicago, Ill



Layout Tool Used in Milling Machine

In some cases, work can be laid out on a milling machine in less time than by other methods and with the necessary degree of accuracy. At other times, this method may prove to be the best approach as, for instance, would be the case where the edge of the work would be rough or irregular and therefore tough to set a piece on.

The tool shown makes it easy to scribe lines and prick punch work locations. It is clamped between collars on an arbor and, by its own weight, provides enough pressure for scribing while a light tap on a striking pin produces a punch mark. These marks will be small so they are later enlarged with a regular center punch.

Two components make up the body of the tool. One is a square or rectangular outer member and the other is a collar which is the section clamped between the arbor collars. The bore of the outer member should be anywhere from 1/32 to 1/16 in. larger than the OD of the collar to provide the necessary clearance. The striking pin on top and the scriber shown at the bottom are locked in the outer section. They have a sliding fit in the collar to keep the two parts in line.

M W Loftus, Chicago, Ill

Putting New Life Into Wire Brushes

Under heavy use in power tools, wire brushes lose their effectiveness as soon as they become twisted and worn. This doesn't mean that they have no value and are ready for the trash can—indeed not. A few minutes spent in refurbishing them will restore most of their original stability. Here's how.

First chuck a brush in a machine or power tool whose rotation can be reversed. Then, as the brush turns opposite to its normal rotation, hold a file against it to unwind and sharpen it. Don't use a good file for this, a worn-out one will do just as well.

After a few of these treatments, it may be necessary to grind about ⅛ in. off the brush casing to add length and flexibility to the wires.

E Mayover, Bradenton, Fla

R Gurney Harpenden, Herts, Eng Won $25 for his idea:

Boring-Mill Micrometer Saves Down Time
in the Sept 5, 1960 issue

AN EXTRA $25 will be paid for the best Practical Idea in each issue of *American Machinist/Metalworking Manufacturing*. Selection of the winning idea is made by a group of our readers.

PAYMENT—in addition to regular rate for item published—will be made as soon as tabulations are completed. The winner or winners—in case of a tie when duplicate prizes will be awarded—will also be announced in these pages.

JUDGES . . . are a group of *American Machinist/Metalworking Manufacturing* readers who select articles they prefer in a particular issue. This group changes entirely with each issue and represents a true cross-section of our readers. Their decision is accepted by the editors, without reservations or bias, as final in each case.

REQUIREMENTS—All items appearing in the Practical Ideas pages are eligible. They must be submitted by the originator on an exclusive basis. Do not worry about your shortcomings as an author, draftsman, or photographer—every item will be edited in accordance with *American Machinist/Metalworking Manufacturing* standards. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of McGraw-Hill Publishing Co. Inc., and those of its advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send all entries to: "Practical Ideas Editor" *American Machinist/Metalworking Manufacturing*, 330 West 42nd Street, New York 36, NY.

Rudolph F Bannow

is that rare combination: a man of ideas and a man of action. (He once sketched out plans for a turret drilling machine on the back of a paper bag, two years later had it in production). This year marks two milestones in the career of this Swedish-born onetime patternmaker—presidency of the National Association of Manufacturers, and production of the 50,000th Bridgeport miller

Success story

At a time when the U S machine tool industry is struggling to emerge from a serious recession, Bridgeport Machines, Inc, Bridgeport, Conn, is producing 125 turret milling machines and five automatic copying millers a week, or about 545 machines a month. A brand-new miller comes off the assembly line every 20 minutes during a 50-hour workweek. The company has been operating at this astounding pace the past nine months. And, despite stiff competition and not exactly a booming national economy, the pace is not likely to slacken in the foreseeable future.

Bridgeport's success has been hard earned. It largely stems from the able, dynamic leadership of ruddy-faced, stockily-built, Swedish-born Rudolph Frederick Bannow, who bears a striking resemblance to Spencer Tracy.

Genial, relaxed, giving an impression of never being in a hurry, Bannow is on a day-to-day schedule that would make most men blanch. Not only is he directly responsible, along with his partner Magnus Wahlstrom, for his company, but currently is president of the National Association of Manufacturers.

As NAM chief he covered 42 States between January 15 and July 3 and will be in many more before his term expires in December, as well as visiting most of the western European nations this fall. He loves to point out that NAM represents 21,000 firms, of which 83% have fewer than 500 employees. His own has 440. Thus the NAM mostly speaks for small and medium-size businesses, not big business.

Now 62, Bannow migrated from his native Gothenburg at the age of 13 to Holyoke, Mass, and the next year started to learn the patternmaker's trade at the Dean Steam Pump Co. During World War I he made some patterns for the famed Liberty engine at the U S Aluminum Co in Fairfield, Conn, and then was employed as a patternmaker by Bullard in 1918-1919.

Following the tradition of his native Gothenburgers, he went to sea for five months, shoveling coal on an American freighter. A few years later (1923) he joined the Bridgeport Pattern & Model Works and soon became a foreman. With several thousand dollars loaned him by his mother, he bought the company in 1927, and two years later linked with Mr Wahlstrom, who had the idea of developing an electric hedge-cutter. The hedge-cutter, however, was forgotten when the two partners threw all their energies into designing a high-speed milling head which soon was put into production.

The basic idea of Bridgeport's turret drilling machines — the turret has a controlled arm enabling you to set it at any angle over the table —came to Bannow in 1936, when he was delivering a pattern to the Bridgeport Brass. Co. He sat down in his half-ton delivery truck and sketched the machine on a paper bag.

The first machine was shipped in 1938, and the next year the company sold its pattern business and incorporated as Bridgeport Machines Inc. On June 6, 1960, Bannow and his partner celebrated an event that few

machine tool builders have matched in a 22-year period if at all—the 50,000th Bridgeport miller came off the assembly line.

What's more, Bridgeport Machines has an unique achievement to its credit. It has had only one price increase in its history—12% in 1951. Whenever increases come along in labor rates and in materials, Bannow sets out to devise ways and means of producing his machines more economically—and he keeps after his suppliers, such as his foundry sources, to do the same thing. He regards as the greatest challenge to our engineers the problem of designing our products to be made against competition, no matter what it is or from where.

If Bannow has any special "secret" formula that has enabled his company to hold down its costs through the years, it is his excellent relations with his employees. His shop is not unionized, but his pay scale and working conditions are of the highest. He has a bonus plan in which everyone participates during profitable years. In the 1958 recession, when the usual sizable backlog vanished, Bannow kept his full force busy turning out machines for stock until he had filled a former plant. Fortunately just then the business tide turned, for the better.

Because of Bridgeport Machines' concentration mostly on one type and size of machine, Bannow and his partner have been able to mechanize far beyond most machine tool builders—and to use great ingenuity in tooling. To those who feel that Russia has the answer to mass-production of machine tools at low cost, Bannow extends a special invitation to visit his shop at Bridgeport.

It is not Bannow's nature to devote all his time to business. He organized the North Star Singers as a double quartet of Swedish-Americans in 1933 and the group grew to sixteen. They rehearsed faithfully every Wednesday night since then—and one of his regrets about his NAM travels is that he has had to miss so many rehearsals this year. A few years ago he headed a group of 47 Swedish-American singers that gave ten concerts in three weeks in Sweden. The age group added up to 3000 years—an average of 64 years.

Bannow's choral group belongs to the American Union of Swedish Singers, the members of which gather nationally for a song fest every four years. There are more machinists and tool makers than any other trade or profession in this organization.

Because of his notable contribution to bettering Swedish-American relations, Bannow was the recipient of the Order of Vasa in Stockholm, Countess Estelle Bernadotte making the presentation. And last December, at the annual NAM meeting, the Swedish Consul-General in New York conferred upon him, on behalf of the Government of Sweden, the Knighthood of the Order of Vasa. As Bannow smilingly remarks, "Some of my friends now call me Sir Rudy" (in Sweden he would be addressed as "Sir Rudolph").

Bannow has been an active participant in Bridgeport affairs—one-time president of the local YMCA, for five years president of the Bridgeport Manufacturers Association, and is currently a trustee of the University of Bridgeport.

A shining example of the success that can be attained in a free-enterprise economy, Bannow is dedicated to the proposition of perpetuating it. He is convinced, however, that plenty of trouble looms ahead, partly because we inevitably are moving rapidly into a one-world economy. Such an economy will provide the supreme test of our ability to compete with foreign manufacturers. The foremost challenge to American industry is how to get across to American labor and to the public the necessity for meeting this test successfully and to enlist their help in the cause.

The spectre of rampant inflation scares Bannow more than any other one thing. "The question that faces us is how far down we can take the present 48-cent dollar before we have chaos," he says. Soaring costs must be controlled to curb inflation, and the only way to do so is for industry and labor to work together.

Our income tax rates also are one of Bannow's targets. "Above a certain level, the government practically confiscates everything." There should be something to reach for—some reward or incentive. The worst thing that could happen to this country is for our industrialists to start playing it safe. They may do exactly that he believes, if the public and the government keep pushing them with little or no understanding of their problems.

Kearney & Trecker Corp, Milwaukee, has elected **John S Randall** executive vice president to succeed **Ralph W Burk** who retired in 1958. Mr Randall was formerly vice president, industrial products group, of A O Smith Corp

Bullard Co, Bridgeport, Conn, has named **Wilfred Thompson** vice president, sales. He has been district sales manager since 1950, with headquarters in Detroit, and prior to that held positions in various manufacturing departments

Buhr Machine Tool Co, Ann Arbor, Mich, has appointed **Henry C Daum** vice president in charge of sales. He was formerly manager in the manufacturing engineering office, manufacturing staff, Ford Motor Co

Jarvis Corp, Middletown, Conn, has promoted three company executives, now general managers of subsidiaries, to corporate vice presidents. They are (left to right) **George Carvalho,** general manager, machine tool and attachments subsidiary, Middletown, Conn; **Joseph Brescia,** general manager, tap subsidiary, North Attleboro, Mass; and **Paul Hanscome,** general manager, carbide tool subsidiary, Lynn, Mass

Borg-Warner Corp has appointed **William F Martin** vice president and assistant general manager of the Mechanics Universal Joint Division which operates plants in Rockford, Ill, and Memphis, Tenn. He was formerly director of manufacturing services for the parent corporation. **Dr Donald W Collier** has been named B-W vice president, research. He was formerly president of the Thomas A Edison Research Laboratory Division of McGraw-Edison Co.

Saco - Lowell Shops, Boston, has elected **James P W Davidson** vice president. He was previously executive vice president of the Automotive Division.

E W Bliss Co has named **Carl H Smith** manager of sales engineering for the Canton Division. He was previously project manager of special and government contracts in the sales engineering department.

Chrysler Corp has appointed **Byron J Nichols** general manager of the **Dodge Division.** Mr Nichols, group vice president of automotive sales, succeeds **M C Patterson** who has retired after nearly 40 years of service with Dodge.

Clearing Division of US Industries, Chicago, has appointed **George Herrick** general manager of automotive sales and **Philip Delmer** general manager of domestic sales. Also named to new assignments: **Louis Tuglas,** as manager of shear sales, will operate with dealers handling the Scrap Shear line of presses; **Dave Bonnar,** manager of dealer press sales; **Dean Cochran,** as manager of hydraulic sales, will handle all hydraulic press sales working with both direct and dealer organizations; **Stephen Miller,** as manager of machine tool sales, will deal with direct dealer sales organization in the lathe division.

Stewart-Warner Corp, Chicago, has elected **Frank A Ryder** a vice president. Mr Ryder is general manager of the **John W Hobbs Corp,** Springfield, Ill, division of S-W.

Frank G Hough Co, Libertyville, Ill, manufacturer of tractors and shovels, has appointed **Jules C Laegeler** vice president, engineering. He was formerly chief engineer.

Link-Belt Co has appointed **Roy E Lambert** assistant general manager of the ball and roller bearing plant in Indianapolis. He was formerly production superintendent.

Worthington Corp, Harrison, NJ, has appointed **Frank J Nunlist** to the new position of vice president, operations. Mr Nunlist was formerly executive vice president of Worthington's Mueller Climatrol Division and was elected a group vice president of the corporation in 1958

Norma - Hoffmann Bearings Corp, Stamford, Conn, has named **William B Clark** manager of manufacturing engineering. **David Albert,** formerly chief customer representative, succeeds Mr Clark as superintendent of inspection and quality control. **Frank H Rae,** previously head of manufacturing engineering, has been appointed chief process engineer.

Waukesha Motor Co has elected **Charles E Nelson Jr** president to succeed **James E DeLong** who is retiring after heading the firm for 25 years. Mr Nelson was formerly executive vice president. **J G Swain** has been elected vice president of the company and **N H Willis** has been appointed vice president, engineering.

National Tool, Die and Precision Machining Association (formerly the National Tool and Die Manufacturers Association) has elected **Harold G Murdock** president. Mr Murdock is vice president of **Arrowsmith Tool & Die Corp,** Los Angeles.

(continued on p 250)

OBITUARY

Frank W Curtis, well known induction and dielectric heating expert, died Oct 17. Mr Curtis was a past president of the American Society of Tool and Manufacturing Engineers and a former Chicago editor of AMERICAN MACHINIST/METALWORKING MANUFACTURING. His most recent business affiliation, prior to his retirement several years ago, was with Morse Twist Drill Co in Detroit where he served as branch manager. He had also been associated with Kearney & Trecker, Firth Sterling Steel Co, P R Mallory & Co, Ford Motor Co, and Van Norman Machine Tool Co.

THE TRS MAN TOOK AN INSIDE LOOK

to save Carling 50% on a toggle-switch part

Carling Electric already used two TRS rivets to assemble snap-acting toggle switches, had no fastening problems for that product. But a stamped brass cap, in the top of each switch spring, kept costs up . . . springs had to be ground flat to seat the cap securely, and costs of brass strip stock, parts inventory, and tool maintenance were high.

Trained in the PAR Process approach to cost reduction, the TRS man saw a way out . . . suggested a dimpled *rivet* in place of the cap, worked out details with Carling engineers. This simple change eliminated spring grinding, stamping tool maintenance, brass strip stock and finished caps inventory. The dimpled rivets improved reliability and smoothness of toggle action, and dependable TRS deliveries removed any need for stocking them ahead of demand. Result: Carling scrapped existing parts inventory, converted to the new design at once.

FIND OUT what the Par Process can save you

The PAR Process aims at lower costs and higher production rates. It starts with a sharp-eyed, production line search by your TRS man, for ways to eliminate or simplify and speed up steps in the assembly — using procedures specially organized by TRS, benefiting from unique TRS developments in rivets and riveting machines.

PAR may bring you better integration and fuller automation of assembly operations, or even a cost-cutting change in design as with Carling. Ask for a check of your operations. Whether your assembly jobs are simple or complex, it can be worth dollars to you.

THE CHANGE THE TRS MAN SUGGESTED

▼ **OLD** stamped cap transmits toggle motion through spring to moveable contact. Requires flat-ground spring to prevent slips and jamming, adds extra costs of strip stock, parts inventory, stamping tool maintenance.

NEW ▶ dimpled rivet does same job better, with precision bearing surface. Sits straight and secure in unground spring, eliminates tool maintenance, removes need for costly in-plant inventories.

Don't Buy Riveting Machines until you learn how the TRS **PAR** *process revolutionizes riveting*

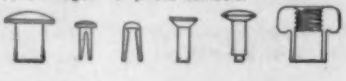
TRS®

TUBULAR RIVET & STUD COMPANY

QUINCY 70, MASSACHUSETTS • TRS SALES OFFICES: Atlanta • Buffalo • Charlotte • Chicago Cleveland • Dallas • Detroit • Hartford • Indianapolis • Los Angeles • New York Philadelphia • Pittsfield • Quincy • St. Louis • Seattle. WAREHOUSE IN CHICAGO

See "Yellow Pages" for phone numbers.

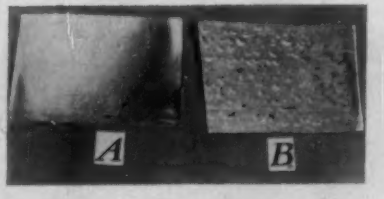
If it's a Tubular Rivet TRS makes it . . . and Better



Accurate's Clad Metals Do Not Form 'Rain Drops' Upon Flowing Solder Overlay

This line of clad metal raw materials and stampings, now in full production, consists of an overlay of a low-melting point solder such as tin, tin-antimony, or lead-tin-antimony clad on one or both sides of a base material such as A nickel, nickel-iron, Kover, copper, gold, or silver. Raw materials can be supplied in 2-in. maximum widths, with a minimum overall thickness of 0.001 in., held as close as ± 0.0002 in. Typical ratios of clad metal to base include 5:95, 10:90, 5:95:5, 15:85, 20:80, 10:80:10.

The cut (above) depicts the problem of de-wetting of clad metal strip. Strip marked A shows this new product after flowing the solder overlay (note that it remains uniform). Strip B is a piece of clad metal made by prior methods. Upon application of heat, the solder overlay balls-up and forms a "rain drop" pattern, which would make it unusable for semi-conductor parts.



In addition to supplying the clad metal strip, which is designed primarily for semiconductor applications, the company also offers clad metal stampings from this new raw material. The solder clad base tab stamping replaces two components with one easy-to-handle precision clad metal part. Stampings are available in diameters from 0.030 in. OD to 2.00 in. OD. Thicknesses vary from 0.001 to 0.010 in. with tolerance on diameters held to ± 0.00025 in.

Accurate Specialties Co, Inc, 340 Hudson St, Hackensack, NJ

MORE DATA? Circle 126, inside back cover

Color Coating Bonds to All Metals in Single Treatment

Hinac chemical surface treating process, which supposedly for the first time color coats all types of metals in a single treatment, is ready for commercial application. The new coating is produced in several grades, clear and colored, which are corrosion resistant, have good weathering properties, and are color fast.

Coatings are applied in an aqueous solution at room temperatures. Because it is a low viscosity solution which covers completely and drips free quickly with virtually no carryover, Hinac can be applied by roller coating, dip, or spray. The only pre-treatment required is thorough cleaning and rinsing, as would be done in any finishing system. Curing time can be as little as a few seconds, depending on the heat source.

Hinac-1 is equal or superior to blackplate in corrosion resistance and can be substituted for organic finishes. Carbon steel, stainless steel, aluminum, and zinc plated steel coated with this grade can be welded better than untreated metal.

Hinac-2 is a heavier grade, providing excellent protection for ferrous and non-ferrous metals. Aluminum and stainless coated with this grade have good resistance to salt spray and good outdoor weathering properties.

Colors include red, brown, green, blue, black, gray, and bronze.

Metal Processing Dept, Pennsalt Chemicals Corp, 3 Penn Center, Philadelphia 2, Pa

MORE DATA? Circle 127, inside back cover

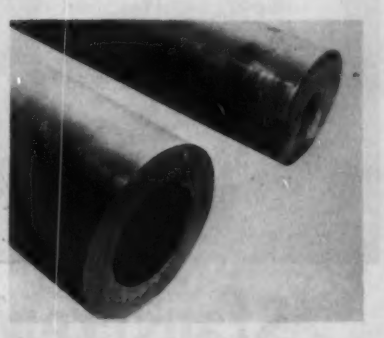
Honing and Superfinish Fluid Said Safe at High Temperatures

Because it has a flash point of 275 F, Formula 50 meets the honing-oil safety requirements of major production plants. In addition, its combination of ingredients permits stock-removal rates as high as those with straight kerosene. The coolant, which is particularly suitable for hard gear honing, has a low odor level and minimizes drying of skin.

Formula 50 can be used with all types of honing and superfinishing machines and, because it is non-sulphurized, it can be used when finishing most metals. This fluid has good solvency and will keep the honing stone clean and free-cutting.

Shear-Speed Chemical Products, Div Michigan Tool Co, 7125 E McNichols Rd, Detroit 12, Mich

MORE DATA? Circle 128, inside back cover



Darwin & Milner's A-2 Tool Steel Offered in Hollow Bars

Mineor FM, which is a deep-hardening, nondeforming tool steel with free-machining properties, is now offered in hollow-bar form. A carefully controlled addition of minute, uniformly dispersed alloy sulfides gives the steel superior machinability and self-lubricating action for die parts without sacrificing mechanical strength.

Because it resists deformation in heat treatment, Mineor MF is said to be ideal for delicate parts where oil-hardening steel might distort or crack. In hollow-bar form, this tool steel is ideally suited for hollow punches on heavy metal, blanking dies, tool holders, and for wear-resistant machine and die parts.

Its composition is 1.00% C, 0.50% Mn, 0.30% Si, 5.00% Cr, 0.25% V, and 1.10% Mo. The steel hardens between 1750 and 1775 F to Rh 63 to 65 C; it can be drawn back to any required hardness. Izod impact strength of un-notched hollow bar at Rh 62.5 C is 104 ft-lb.

Mineor FM hollow bar is available in size range from 2¼ to 16¼-in. OD, ¾ to 9¾-in. ID, with wall

IT PAYS TO STANDARDIZE ON **STANSCREW**

Stanscrew service helps insure precision of *Gilbarco* pumps

Gilbert & Barker Mfg. Company builds its famous Gilbarco gasoline pumps for oil companies large and small, and ships them to every state in the union as well as to most countries overseas. To insure precision and dependability of these pumps, great care must be taken in all assembly operations. Fasteners, for instance, must be torqued precisely to keep all components in perfect alignment.

Because of the critical importance of fasteners to its products, Gilbarco has selected Stanscrew heat-treated cap screws for such key applications as the positive displacement meter (shown in the insert). Stanscrew fastener specialists were happy to assist Gilbarco engineers in determining the right fastener with the correct torque to assure trouble-free service.

Gilbert & Barker is one of a long roster of honored names in American industry who have found it pays to standardize on Stanscrew. A product of unsurpassed quality . . . a broad selection of more than 5,500 different fasteners . . . prompt service through local distributors, backed by complete stocks at three conveniently located plants . . . these are a few of the reasons Stanscrew means greater value in fasteners.

Stanscrew's experienced fastener specialists can often suggest ways to improve your assembly procedures. Your local Stanscrew distributor will be happy to arrange a prompt visit. Call him today.

STANSCREW FASTENERS

CHICAGO | THE CHICAGO SCREW COMPANY, BELLWOOD, ILLINOIS
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

thicknesses from ¾ to 4½ in. Surfaces are rough machined, leaving ⅛ in. for finishing.

Darwin & Milner, Inc, 2222 Lakeside Ave, Cleveland 14, Ohio

MORE DATA? Circle 129, inside back cover

Solder Flux Is Suitable For Electronic Component Soldering

A mildly activated rosin type flux, called the Fusion RU series, has been tested neutral both before and after soldering. Therefore, it is acceptable for electrical and electronic work where non-conductive, noncorrosive flux residues are required. The RU series makes possible much more rapid soldering—up to 100% in some cases—than had previously been possible with neutral fluxes.

A secondary advantage to the production speedup possible is the lack of flux removal after soldering. Humidity chamber tests have definitely determined that the flux is noncorrosive after soldering and thus suitable for fine electronic component soldering.

Metals easily wet by this flux are mild steel, brass, copper, tin, lead, cadmium, and silver plate.

Fusion Engrg, 17921 Roseland Ave, Cleveland 12, Ohio

MORE DATA? Circle 130, inside back cover

Blocky Type Natural Diamond Grit Now Offered on Commercial Basis

Following extensive field evaluations, SND-MB (Blocky) natural diamond grit is now available on a fully commercial basis. Especially suited for metal bonds, the blocky grit has thus far principally been used in grinding wheels, saws, impregnated drill bits, and similar tools for use on concrete, glass, tile, ceramics, stone, and cemented carbides.

Industrial Diamond Div, Engelhard Hanovia, Inc, Newark, NJ

MORE DATA? Circle 131, inside back cover

Heat-Resistant Liquid Latex Makes Polyester, Epoxy Molds

Admold, a new heat-resistant liquid latex which is excellent for making rubber molds to be used for casting polyester and epoxy resin compounds, makes it possible to cast intricate parts from polyester in rubber molds which will resist heat generated by polyester compounds while curing. Molds can then be easily stripped off when the polyester cures.

The compound, which requires no mixing prior to use, can be applied by brush, spray, or dipping. It is self-vulcanizing and will air dry at room temperature, although drying can be accelerated with heat, if desired.

Admold is available from stock in 55-gal drums and in one- and five-gal containers. Illustrated booklet available.

Adhesive Products Corp, 1660 Boone Ave, New York 60, NY

MORE DATA? Circle 132, inside back cover

Cast Iron Machining Improved

A new machining compound is said to prevent deposits of cast iron chips on chucks and machines and also to stop rust of chips, parts, and tooling. The new product, compound 588, makes a milky emulsion when dispensed in water.

Baker/Gubbins Co, 1448 Wabash Ave, Detroit 16, Mich

MORE DATA? Circle 133, inside back cover

Burnishing Soap Compound Designed for Barrel Finishing

Tumb-L-Lustre S-78, a new burnishing soap compound especially developed for burnishing stainless and aluminum, is absolutely neutral and imparts better color and luster than do ordinary compounds, according to the maker. Available in any quantities, price advantages are stipulated in the 25 to 99 and over 100 lb range.

Tumb-L-Matic, Inc, St Mary's St, Stamford, Conn

MORE DATA? Circle 134, inside back cover

Lubricant Eases Stresses In Hard-to-Work Metals

Anchorlube, which was specifically developed for metalworking jobs that commonly cause trouble, is said to ease extreme stresses to which tools and work are subjected in the stamping and machining operations on hard-to-work metals. It can be used on stainless, high carbon, high chrome, cast iron, and monel in almost any metal removal or forming operation.

Because it contains no oil, Anchorlube is extremely clean, and creates none of the difficult cleaning problems connected with white lead and similar materials. The lubricant is odor-free, harmless to skin, and will not rust metals on which it is used.

Anchorlube is packaged in 2 and 8-oz plastic squeeze bottles, ½-pt open-top cans, 1 and 5 gal pails; drums and half-drums filled to order. Free trial sample available.

Anchor Chemical Co, PO Box 2775, 10719 Briggs Rd, Cleveland 11, Ohio

MORE DATA? Circle 135, inside back cover

Oakite Burnishing Compound Eliminates 8 Production Steps

Oakite FM 286—which is designed for burnishing zinc, aluminum, steel, and other metals—works well on all metals except magnesium. Unlike most other burnishing compounds, it is mildly acidic, and produces brilliant blue-white color on zinc diecastings.

It often eliminates the need for the bright dip operation on metals which develop oxide films; it has greater hard-water tolerance than comparable materials. Since it contains no soap, it will not leave a film to hinder plating.

After extensive field testing, one user of FM 286 reports that operations have been cut from nine steps to one, and estimates consequent savings of $50,000 a year.

Oakite Products, Inc, 124 Rector St, New York 6, NY

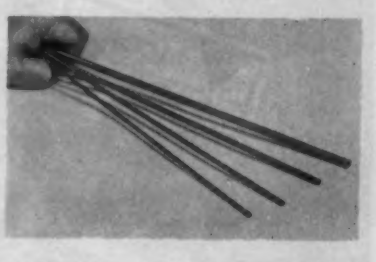
MORE DATA? Circle 136, inside back cover

Remover Works on All Size Parts

A new rust remover, which has improved chemical additives and is called Cor-O-Dex, may be applied to any metal surface by brush, spray gun, cloth, or immersion. The remover dissolves and removes rust, without the slightest change in dimensions, from the smallest parts and tools to large machines.

Allied Products Co, Dept AM, 1133 W Newport Ave, Chicago 13, Ill

MORE DATA? Circle 137, inside back cover



CAST AND CENTERLESS GROUND hard-surfacing rods, which are made to exact chemical specifications for maximum protection of metal parts against abrasion and corrosion conditions, are usually within tighter chemistry limits than corresponding AWS specifications. These rods can be applied by oxy-acetylene flame or electrode coated for arc deposit methods. Rods from ⅛ to ⅜ in. come in controlled lengths of 14 in.; 1/16-in. rods come in random lengths from 6-in. minimum—*WaiMet Alloys Co, Div of Howe Sound Co, 5320 Oakman Blvd, Dearborn, Mich*

MORE DATA? Circle 138, inside back cover

An invitation

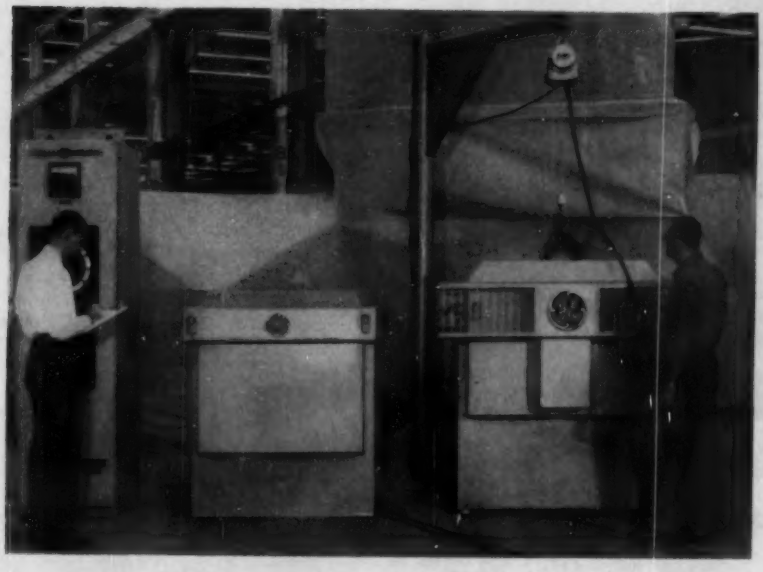
You are cordially invited to join this distinguished group of companies who have entrusted us with the responsibility for solving subcontract problems on components, assemblies and complete, high-precision machines.

Your subcontract headaches will disappear fast in TMW's million square feet of completely integrated manufacturing facilities which include: 1200 *modern* machine tools, a completely mechanized foundry (one of the country's largest), 3000 skilled craftsmen with a corps of industry's top designers and engineers.

TMW's facilities and 65 years' experience in precision (tolerance to 10ths) manufacturing is available to you *now*, on a short or long-term basis. For more details, or for new Facilities File Folder, call or write: Textile Machine Works, Contract Division, Reading, Penna.

TEXTILE MACHINE WORKS

CONTRACT DIVISION • Reading, Pennsylvania



General Electric's Fluidized Bed Brings New Concept to Heat Treating Industry

The fluidized bed gives high production and quality because heating rates are faster and temperature is more uniform than in radiation or forced-convection furnaces. In addition, quenching rates can be varied in the range between oil and air.

In the furnace (right), parts being heat treated are surrounded by a dense disperson of highly turbulent particles suspended by an upward flow of controlled gas. Air or any controlled atmosphere can be used. These particles act like a true liquid; however, they are inert. Therefore, they will not wet, abrade, corrode, or otherwise affect the eqiupment or work. There are no toxic fumes, and no post-cleaning of work is needed.

Heat transfer rates in the fluidized bed are roughly equivalent to lead or salt baths. This allows reductions of heating time up to 85% of that required in forced convection or radiation furnaces. (See below, left, for a comparison with conventional furnaces, and notice that fluidized bed, lead, and salt bath heating rates are comparable.)

The fluidized bed principle can also be applied to quenching by using a cooling instead of a heating element. Cooling rates are variable in the intermediate range between oil and air. This is the answer for hard-to-quench parts that require controlled rates in this range. (See below, right.)

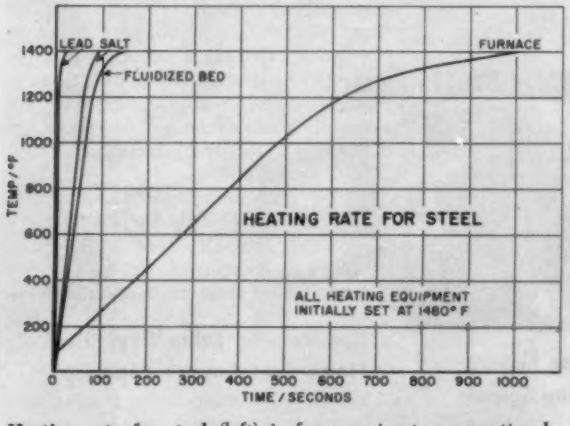
Precise temperature control and uniformity of temperature are most important in heat treating materials. In the bed, work temperature and control temperature are identical, and results are within a ± 5F range.

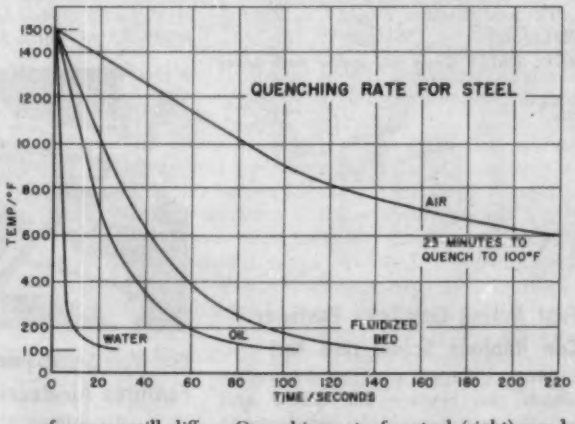
A wide variety of work-handling equipment can be used with the fluidized bed. Parts can be processed individually or in batches, using trays, baskets, or fixtures. Equipment can be designed for using cranes, elevators, or other equipment.

The fluidized beds come with conventional on-off control, or Reactrol control, which is recommended where precise temperature control is necessary. They can be equipped with a strip chart or round chart recorder to give day-by-day records.

General Electric Co, Industrial Heating Dept, Shelbyville, Ind.

MORE DATA? Circle 51, inside back cover





Heating rate for steel (left) is far superior to conventional furnaces. Equivalent time savings can be made with aluminum, copper, stainless, and magnesium, although slopes of curves will differ. Quenching rate for steel (right) can be varied in a wide range between air and oil. Example for a typical steel is shown

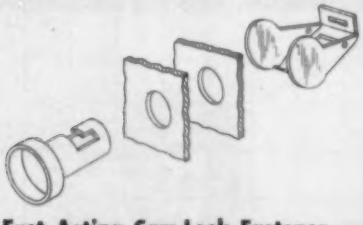
Moving Bolster Assembly, In Single Or Double Model, Cuts Die Change Time

A new type of moving bolster assembly is said to give the quick die change at a cost lower than moving bolster arrangements previously available. The assembly can be furnished as either a single moving bolster or a double bolster unit.

In the single unit, the bolster is mounted on a self-contained traction unit which moves on trolley type wheels over tracks on a table extending from one side of the press or the other. Double units (shown) use extension tables on both sides of the press; therefore, when one bolster is in pressing position, the other is on the extension table where tooling changes can be made during press operation.

Verson Allsteel Press Co., 9300 S Kenwood Ave., Chicago 19, Ill.

MORE DATA? Circle 52, inside back cover



Fast Acting Cam-Lock Fastener Can Replace Screw and Nut

This two-piece fastening device — which can replace the screw and nut for many assembly applications —consists of a stud and cam. The stud is inserted into pieces of metal to be joined, and the cam-fastener is inserted into the notch and snapped over.

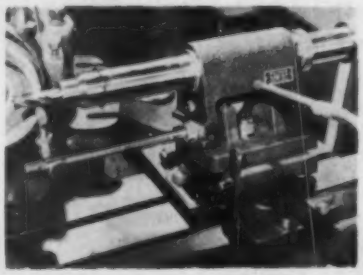
Because the fastener's cam has been pushed over past its high point, it cannot work loose — even under heavy vibration. However, it can be easily opened with a flick of the thumb.

This fastening assembly is priced slightly less than domestic nut-screw assemblies. When ordered in large enough quantities, it can sell for even less, because the stud can then be made from plastic.

Combined metal thickness for a specific assembly can vary as much as 0.015 in. before a tight fit is lost.

Row Products Co, 254 Lawrence Ave, Lawrence, LI, NY

MORE DATA? Circle 53, inside back cover



End-Mill Sharpening Fixture Features Air-Bearing Spindle

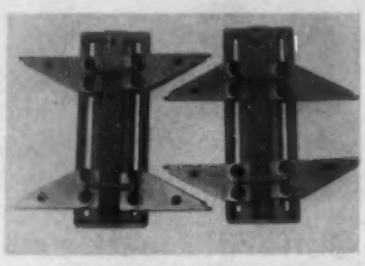
This new end-mill sharpening fixture, which mounts directly on the table of any make tool grinder, has a precision spindle supported by an air bearing. Because the air bearing minimizes friction, tool-sharpening is speeded up; yet, the operator still has the "feel" of grinding action while getting good precision.

The air-bearing-mounted spindle accommodates straight-shank end mills from 3/16 to 1¼-in. dia with a matched bushing set. The No. 7 combination end-mill sharpening fixture with air spindle—which sells for $300 —consists of a sub-base, rocking head, finger-arm assembly, air-spindle assembly, and tools necessary for servicing.

An air-conversion kit for existing end-mill sharpening fixtures, the No. 7 AC, is priced at $112.50.

Weldon Tool Co, Cleveland, Ohio

MORE DATA? Circle 54, inside back cover



Speed Tool Offers Adjustable Go-No Go Gage, Said to be First

This adjustable go-no go gage, said to be the first of its type on the market, has two pair of independently adjustable, oppositely opposed and spring loaded gaging arms. One pair of these can be set for a given go dimension, and the second pair of gaging arms on the other side of the center rib set for a given no-go dimension. Therefore, the gage can be used to check both ID and OD where face grooves, rings grooves, O-rings, thread reliefs, and slots are machined or inspected in quantity.

Model 900 has a capacity of 5 in. with the arms set in relation to each other (as shown at left) and approximately 3 in. when set as shown on the right. Accuracy has been tested to the millionth.

The gage, which eliminates much special gaging, sells for $39.50.

Speed Tool Co, 1144 N La Brea Ave, Los Angeles 38, Calif

MORE DATA? Circle 55, inside back cover

Non-Metallic Table Ways Give Flying Scot Greater Capacity

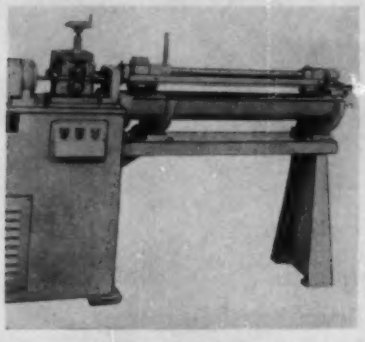
Plastic table ways—now available as optional equipment on the Flying Scot (see *AM/MM*—Apr 18 '60, p148) small planer—increase the ma-

chine's load-carrying capacity 100% over that of cast iron ways. By permitting higher cutting and return speeds, these ways increase planer productivity and reduce planing costs.

The ways consist of laminated plastic plates cemented and pinned to the table ways. Higher cutting and return speeds are achieved because heat generated at the bearing surfaces is virtually eliminated.

G A Gray Co, Dept A-619, Cincinnati 7, Ohio

MORE DATA? Circle 56, inside back cover



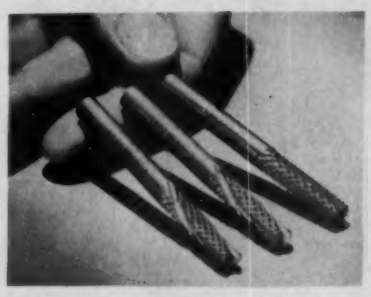
Shuster Machine Straightens And Cuts 1/16 to 1/8-in. Wire

New Shuster Model 1V18 variable speed automatic wire straightening and cutting machine, for wire ranging in diameter from 1/16 to 1/8 in., is geared for feeds from 25 to 150 fpm, and easily adapts for shaped stock. The machine makes cuts up to 8-in. long at rates to 200 a min.

Other features include: high speed straightening arbor which has five elongated split-dies; angled electric control panel for one-position operation; Micro Switch trips; target with positive setting and release; solenoid operated roll-type clutch.

Mettler Machine Tool Inc, Adeline St and Boulevard, P O Box 883, New Haven 4, Conn

MORE DATA? Circle 57, inside back cover



Line of Carbide Cutting Tools Designed for Hi-Hard Plastics

This new line of carbide cutting tools was specially designed to hold up under the highly abrasive properties of fiber glass, milamene, plexiglas, the laminated plastics, and similar materials. Rout-o-Mils for routing, milling, and trimming are available in 1/16 to 1½-in. diameters.

The carbide slitting saws are available in ¼ to 1½-in. diameter in 0.010 to 0.060 thicknesses; routing cutters—in one or two flutes, right or left spiral—have diameters from ⅛ to ½ in. and flute lengths from ½ to 1 in.

Dixie Tool Industries, Inc, Bridgeport, Mich

MORE DATA? Circle 58, inside back cover

Sterling Drill Grinder Takes Minimum Time for Setup Change

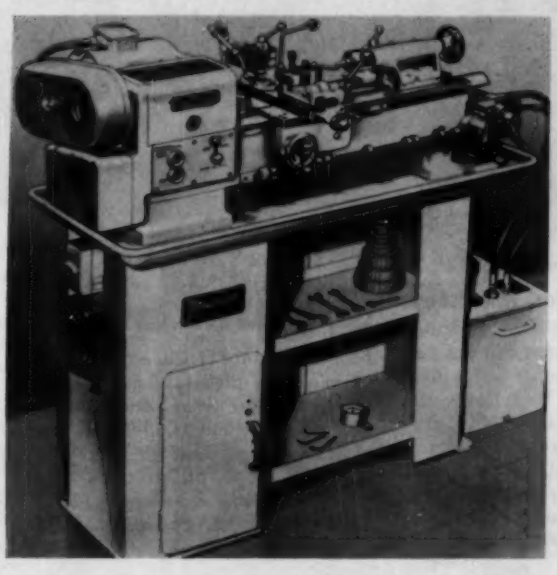
Grinding 59° drills accurately with a free cutting conical form on all sizes from ⅛ to 2½-in. diameter can be done quickly on this new Model DF Sterling drill grinder. Because no chucks or collets are required to hold the drills, it takes minimum time to change setups for various sizes.

A built-in clearance angle adjustment, with easily read gage, allows positive setting of 8, 10, and 12-degree clearance on any size drill.

Model DF is powered by either a ½ or 1 hp, 3450 rpm motor and uses a 6 x 1½ x ½-in. straight cup wheel with 4 x 1-in. recess. A built-on diamond wheel dresser is standard equipment.

McDonough Mfg Co, Eau Claire, Wis

MORE DATA? Circle 59, inside back cover



Bentley Introduces Hydraulic Tracer Lathe Designed for Small Component Duplicating

Said to be the first true hydraulic tracer lathe engineered throughout for small component duplicating, the Myford Mini-Kop has a hydraulic feed to the carriage which allows finger-tip operation of carriage motion with accurate length control.

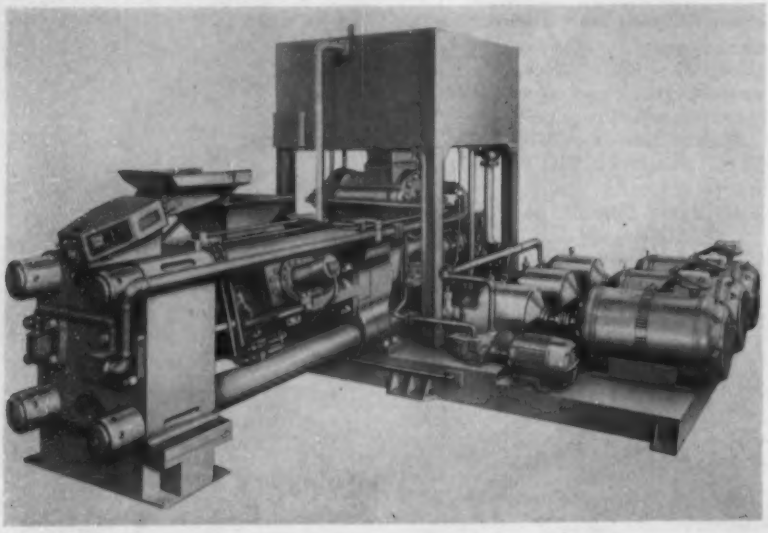
Because the reproducer unit works with low stylus pressure, unhardened templates can be used. Longitudinal repeat accuracy to deadstops is 0.001 in. and repeat accuracy on diameter from flat or round templets from 0.001 to 0.0005 in. can be obtained.

Specifications include: swing over bed, 7 in.; distance between centers, 17½ in.; Maximum copying length, 14 in.; maximum swing of hydraulic reproducer, 2½ in.; headstock motor, 2 hp; hydraulic pump motor, 1/3 hp.

The lathe is flexible enough to solve almost any small diameter repetition problems, and can produce a surface finish of 20 microin.

Dist by Bentley Industrial Corp, 21-19 46th Ave, Long Island City 1, NY

MORE DATA? Circle 60, inside back cover



Giant-Size Briquetting Press Handles Up to 9 Tons of Metallic Scrap an Hour

Model AL-1000 fully automatic briquetting press, which is said to be the largest of its kind ever produced, is powered by three 125-hp electric motors. The machine converts up to 9 tons of machine tool scrap per hour into cylindrical briquettes having a density of 80 per cent. Individual briquettes weigh from 30 to 40 lb each, and they are classified as high grade scrap.

All moving parts are lubricated by pressurized operating fluid. Cylinder pressure plates and die holders are cast steel; piston rods are chrome nickel steel, hardened and ground.

Briquettes—which can be made of cast iron, steel, uranium, zirconium, bronze, brass, aluminum, magnesium, titanium, and molybdenum—are suitable for direct charging into furnace or cupola.

Milwaukee Foundry Equipment Div, SPO, Inc, 6430 W Bruce St, Milwaukee 46, Wis

MORE DATA? Circle 61, inside back cover

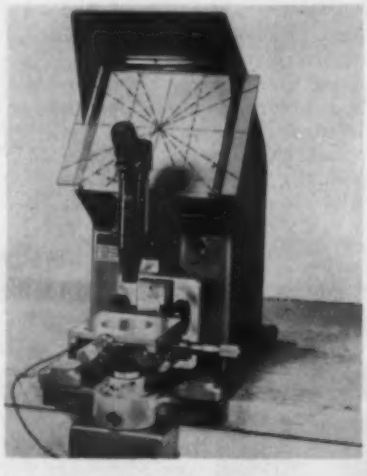
Biddle Offers Complete Line Of Dovetail Machine Slides

Complete line of precision heavy duty dovetail machine slides—which are fitted with tapered gibs—is available in widths of 2, 3, 4, 5, 6, and 8 in. with strokes up to 12 in. in the larger sizes. In addition to the plain, cylinder, screw, and spring operated styles, rack operated and lever operated series are available.

Maintenance is reduced by requiring only a single adjustment to set the slide for proper operation. Once the adjustment is made the slide will operate for a long time without further attention.

Biddle Engrg Co, P. O Box 98, Warrendale, Pa

MORE DATA? Circle 62, inside back cover



Wilder Inspection Instrument Combines Comparator, Microscope

New model small parts comparator combines two instruments in one: an optical bench comparator and a toolmaker microscope. It follows the same prinicple of design as in previous models of Micro-Projectors.

In this new model an additional and unique feature is available for converting the instrument into a toolmaker microscope simply by replacing the projection lens by a Leitz toolmaker microscope tube as shown. This is particularly valuable in higher magnifications and measurements in surface illumination.

Other features include ample working distances in all objectives for assembly operations, both in transmitted and reflected light, as well as a sliding screen.

Opto-Metric Tools, Inc, 137 Varick St, New York 13, NY

MORE DATA? Circle 63, inside back cover

Tilting Barrel Finisher Speeds Small-Lot Handling

Model TC-1V combines a tilting barrel with 19 to 44-rpm variable or fixed speed drive. The 1.1 cu-ft capacity is designed for small lots, pilot operations, or special finishing jobs. Barrels are available in open conical or closed hexagonal types, one or two compartments, measure 17 in. across corners, and are vinyl plastic lined.

Standard controls include ¼-hp 110-v motor and start-stop pushbutton. Unit occupies 41 x 27 in. of floor space and is 46 in. high.

Ra.npe Mfg Co, 14915 Woodworth Ave, Cleveland 10, Ohio

MORE DATA? Circle 64, inside gack cover

K&S VACUUM PENCIL eases handling of miniature pieces of metal, paper, glass, plastics, gems, and biological specimens down to 0.015-in. dia. Available with four different interchangeable tips, it is priced at $74 plus postage—*Kulicke & Soffa Mfg Co, Inc, 1234 Callowhill St, Philadelphia 23, Pa*

MORE DATA? Circle 65, inside back cover

Here's a Hot Number

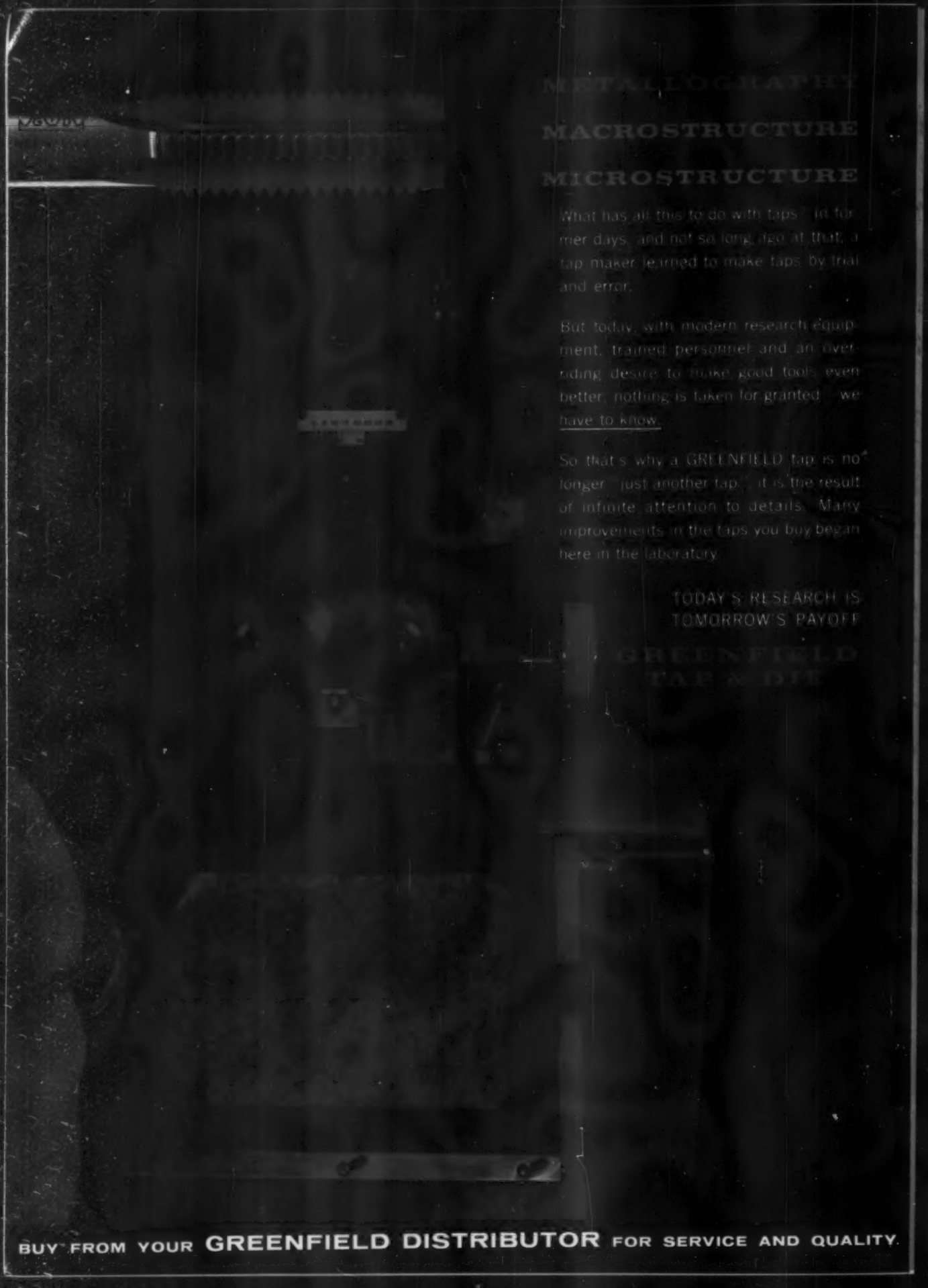
On "Acorn" Dies truly concentric adjustment demands lands with uniform "give".

Spring tempering by precision induction heating (controlled time and temperature) is one more manufacturing refinement that helps make *genuine* "Acorns" the HOTTEST BUY in spring type dies.

"ACORN" means GREENFIELD — GREENFIELD means QUALITY

GREENFIELD TAP & DIE

GREENFIELD, MASSACHUSETTS



METALLOGRAPHY

MACROSTRUCTURE

MICROSTRUCTURE

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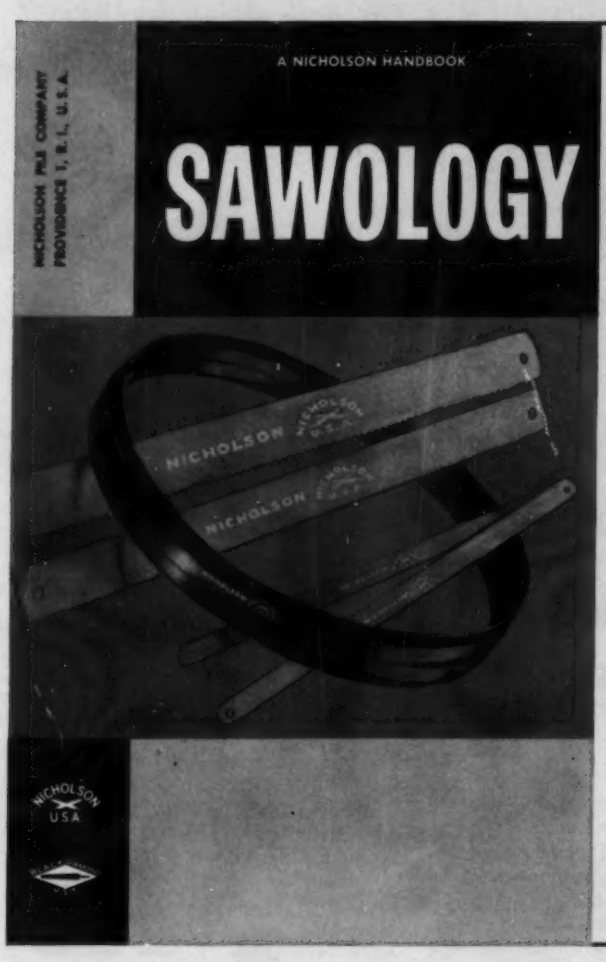

Sawology

— being a brief account of the History, Manufacture, Variety and Uses of saws for the cutting of ferrous and non-ferrous metals, hard plastics and rubber, wood, and other dense materials . . . A useful handbook and guide for the shop superintendent, production foreman, mechanic, or home craftsman.

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Written especially for Nicholson. Draws on all our facilities, skills and experience with metal separating jobs and appropriate tools. This is one of the first books of its kind dealing with the manufacture, proper selection and effective use of saws for cutting ferrous and nonferrous metals, hard plastics and rubber, wood, other dense materials.

Pages are illustrated with numerous photographs and diagrams. Text is straightforward and easily understood by anyone who deals with metal saws. This complete, handy book contains information for shop superintendent, production foreman, mechanic, machinist, maintenance man, purchasing agent, mechanical trainee . . . anyone connected with the management or operation of your shop, plant or industry.

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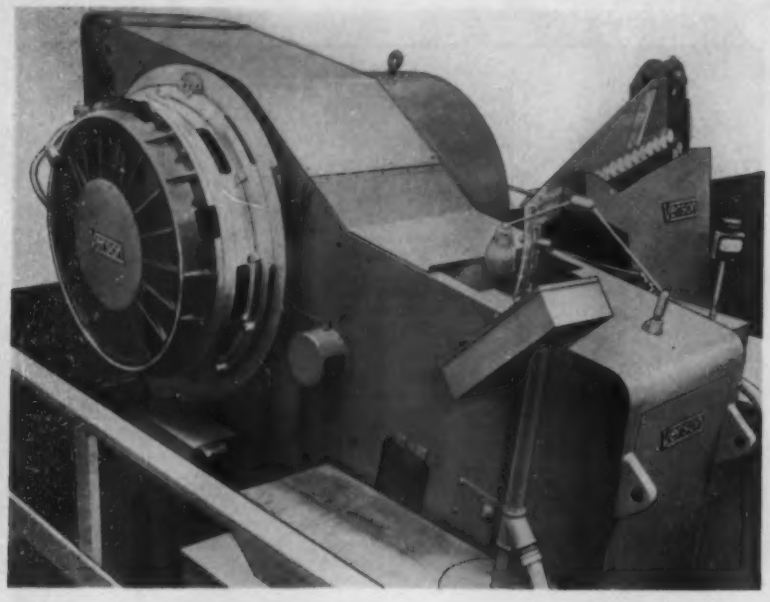


Verson Horizontal Extrusion Machine Operates at Over 200 Strokes per Min

This new horizontal extrusion machine, which makes aluminum cans and containers at more than 200 strokes a min, extrudes the can in a single stroke from a 2.6-in. dia by 0.164-in. thick slug. Said to be moderately priced, the press is rated at 400 tons and has hopper feed.

The can is completely formed except for rolling of the lip, which is done in a separate machine. It is expected that the press will find extensive use wherever canners wish to combine the advantages of aluminum cans with the economy and convenience of making cans on their own premises.

Verson Allsteel Press Co., 9300 S Kenwood Ave., Chicago 19, Ill.

MORE DATA? Circle 70, inside back cover

Gooseneck TIG-Welding Torch Bends into Any Desired Curve

A new controlled angle welding torch —for use in tungsten inert gas arc welding—has a flexible body that can be readily hand-adjusted to any angle as well as extended to reach into difficult recesses. It's flexible the way a gooseneck lamp is flexible; once bent, it will hold that shape until the operator changes it.

The torch, which eliminates the need for stocking a number of torches with different head angles, is now available in a water-cooled model which is rated at 180 amp ac-dc, continuous duty; 300 amp, intermittent duty. Higher and lower rated water-cooled torches as well as an air-cooled model will soon be available.

Falstrom Company, 147 Falstrom Court, Passaic, NJ

MORE DATA? Circle 71, inside back cover

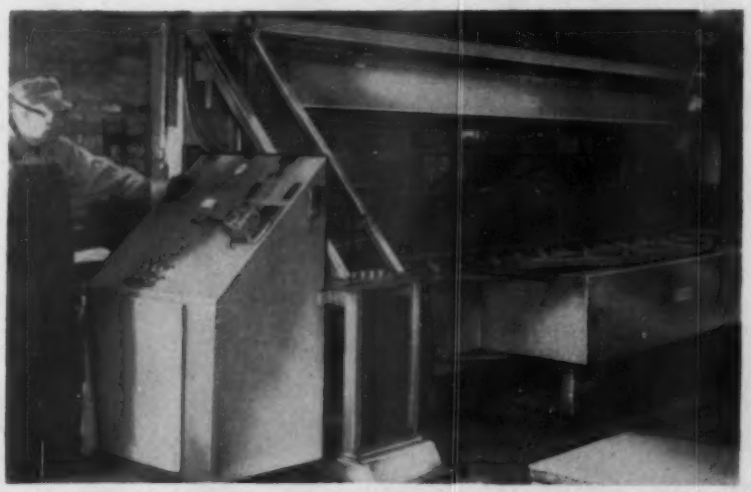
Hammond Introduces Adjustable-Speed Polishing, Buffing Heads

New variable-speed automatic polishing and buffing heads have dial control with which proper wheel speed can be selected while the head is running. Various speed ranges are available.

Because speed can be increased as wheels wear, they should give maximum production.

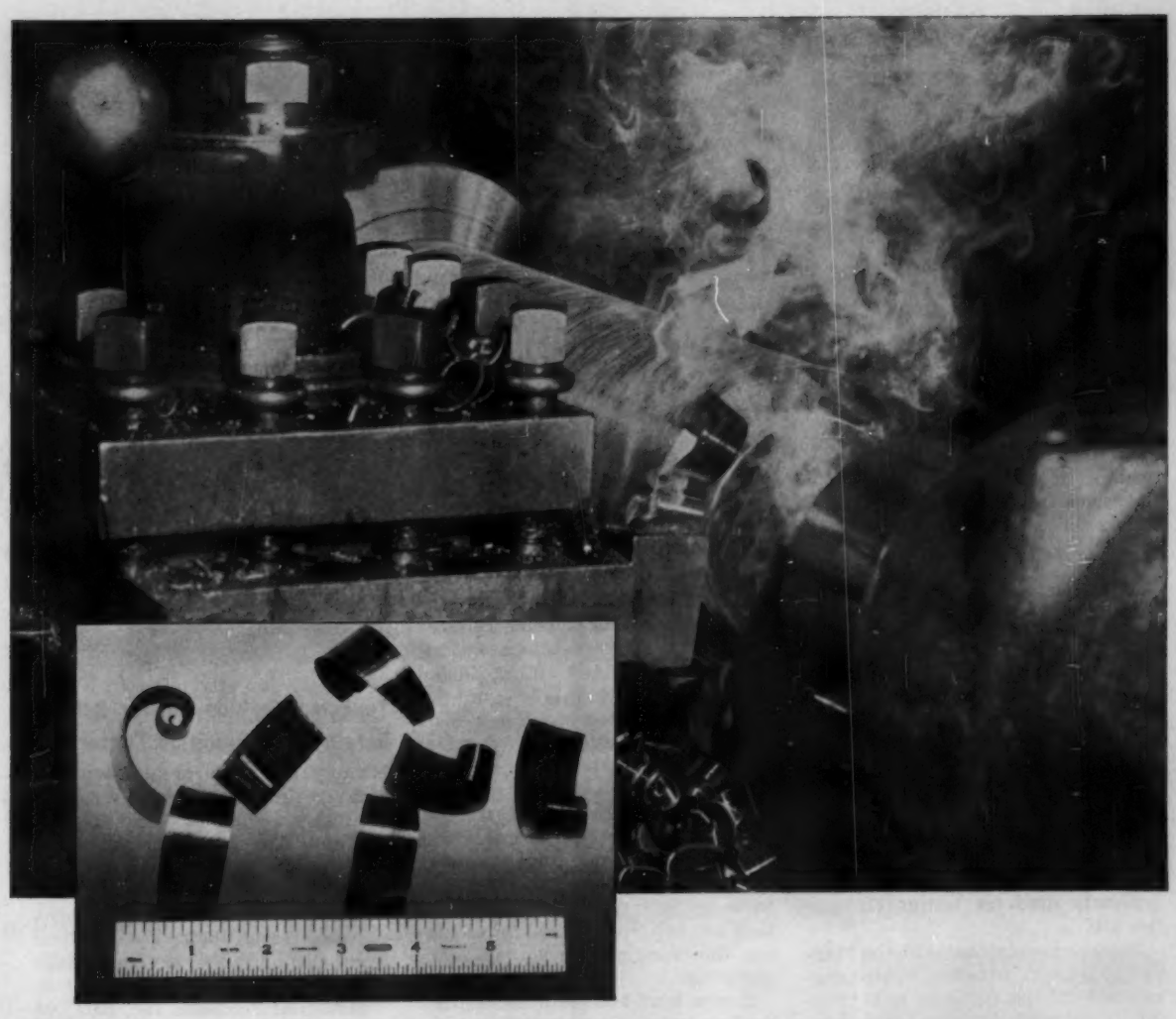
Hammond Machinery Builders, Inc, 1618 Douglas Ave, Kalamazoo, Mich

MORE DATA? Circle 72, inside back cover



HIGH SPEED TRAVERSE CUTTING MACHINE will handle stainless and highly abrasion-resistant plate with approximately .45 to .50% carbon in thicknesses from ¾ to 1½ in. Designated the Model T-20, the machine will cut plate in lengths up to 12 ft—*Stone Machinery Co, Inc, 151 Fayette St, Manlius, N Y*

MORE DATA? Circle 73, inside back cover



Chips like these boost machine output at HEWITT-ROBINS

The ability of VR-77 on heavy interrupted cuts gives Hewitt-Robins maximum machine output per dollar of machine investment. At their Robins Conveyors Division Plant in Passaic, New Jersey, VR-77 is used for maximum metal removal on 1045 cold rolled steel, taking a 0 to ⅛" cut at 300 s.f.p.m. with a .026" feed. Downtime has been cut in half because VR-77 removes twice as much metal per index as the previously used carbide brand.

Regardless of your particular machining problem, there's a V-R carbide specifically engineered to help you boost your machine output.

Send for Catalog VR-58 for complete details.

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V-R VASCOLOY-RAMET

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C-773

Advance Introduces New Line Of Portable Hardness Testers

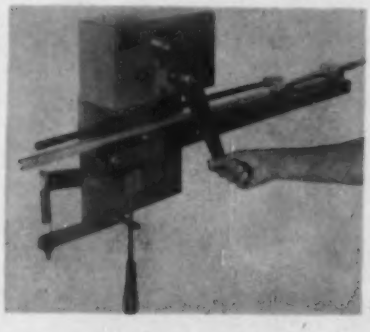
Two models of hardness testers, which are the first in an entirely new line, provide Rockwell hardness readings for all standard and special scales and use loading and penetrators in accordance with ASME and ASTM specifications. The loading mechanisms of both units have a beryllium copper spring which eliminates all weights, levers, and knife edges and also provide permanent calibration.

The Introdyne H-1 (shown) is the first of a series of non-magnetic models. Because it has no weights, levers, or pulleys, this device requires no levelling and can be moved from place to place with no special installation. Although it is designed essentially as a bench unit, the H-1 weighs only 21 lb and can be conveniently used for testing right at the job.

Standard equipment with the Magnedyne, which attaches electromagnetically to the material to be tested, is an adapter shoe which permits the unit to be attached to curved surfaces from 2-in. radius down to flat. The unit weighs but 23 lb, and is completely portable.

Advance Industries, Inc, 640 Memorial Dr, Cambridge 39, Mass

MORE DATA? Circle 74, inside back cover



Acromark Announces Graduating, Name-Plate Marking Machines

No. 598 graduating machine (above) marks accurate calibrations on aluminum, brass, and other metal tubing. A single rotation of this manually operated machine's 8-in. diameter marking wheel provides fractional graduations on a 24-in. tube.

To operate, it is only necessary to slide a tube into the mandrel, swing the cam lever, and turn the hand wheel one rotation. All operating parts are covered and guarded but they are easily accessible for changing the marking wheel and other servicing.

A new semi-automatic name-plate feeding and stamping unit, that takes name-plates up to 4 x 4 in. (larger by special construction), can be used in standard types of punch presses that are constructed with open backs.

The name plate magazine is adjustable to accommodate plates from ¾ x 2 in. up to 4 x 4 in. Plates are automatically slid from the bottom of the magazine into stamping position with each plate automatically ejecting a previously stamped plate. A complete plate is ejected at each stroke of the press and feed slide.

The Acromark Co, 7-13 Morrell St, Elizabeth, NJ

MORE DATA? Circle 75, inside back cover

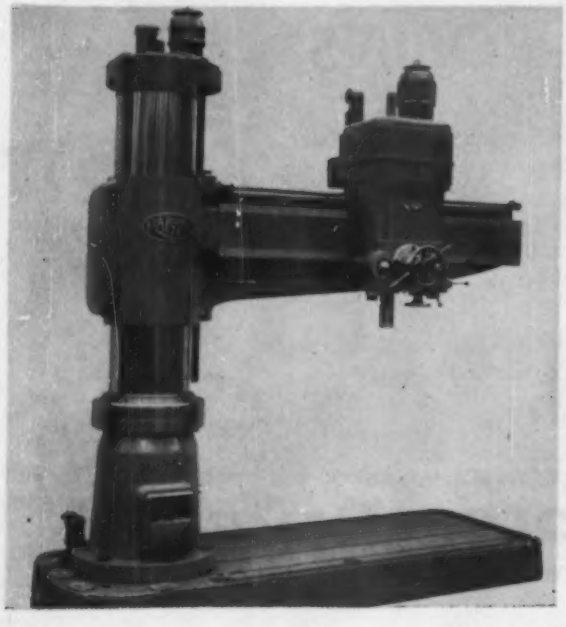
Tungsten Carbide Master Balls Retain Their Precision Longer

Master balls made of tungsten carbide to ± 0.000010-in. (ten millionths) size tolerance and sphericity, and 1-micronich finish can be used for simplified checking of hole depth, ID's and internal tapers, setting and checking comparator gages.

These master balls are available from stock in sets or individually in 31 sizes, from 1/16 through 1 in.

Industrial Tectonics, Inc, Ball Div, 3686 Jackson Rd, Ann Arbor, Mich

MORE DATA? Circle 76, inside back cover



German Radial Drilling Machine Features Automatic Run-Off of All Operating Steps

Made by the Raboma Co of West Berlin, this radial drilling machine features "automated operation," which the company defines as automated run-off of all operating steps. Accuracy is guaranteed independent from the skill of the operator, yet operation is simpler, instead of more intricate.

All control elements are conveniently arranged on the front plate of the drilling slide; control mechanism is hydraulic and consists of only a few parts.

Other features include: preselection of spindle speed and feed while spindle is running; push-button controlled clamping and releasing of column and drilling slide in fixed sequence; feed-trip boring after fine adjustment of depth with releasing accuracy of 0.0040 in.; automatic disengagement of drilling spindle for rotating spindle by hand while changing tools; gear train feed with automatic interruption at both ends of spindle stroke.

Dist by Columbia International Corp, 10-35 44th Dr, Long Island City 1, NY

MORE DATA? Circle 77, inside back cover

let's talk CAPACITY

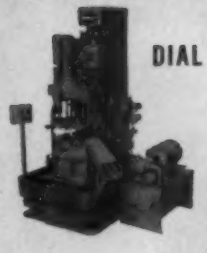
CAPACITY, what does this represent in terms of dollars to a prospective buyer of metal cutting machines.

We at **MICHIGAN** feel that manufacturing **CAPACITY** is an important asset and most beneficial time saving aid available. We constantly strive to improve our manufacturing and assembly methods, this in turn increases our **CAPACITY.** The ability to manufacture machines in less time, results in a low product cost to the customer.

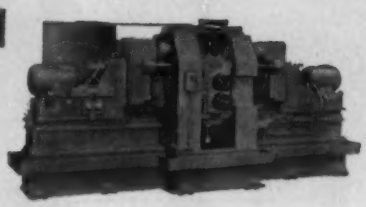
- Modern Building.
- Excellent plant facilities.
- Complete engineering.
- National sales staff.
- Blueprint and duplicating departments.
- Manufacturing facilities to machine every detail in all of our many components.
- **MICHIGAN** designs and fabricates electrical, hydraulic and lubrication installations.

All this represents **CAPACITY.**

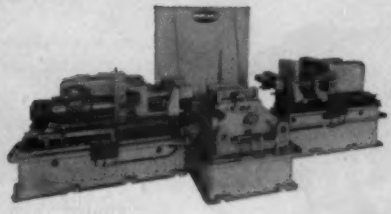
MICHIGAN'S CAPACITY pays off in savings to our customers. If you're looking for a special metal cutting machine of any kind, remember **MICHIGAN**—we specialize in dependable delivery, low product cost and excellent service. Send us your inquiries, we will be pleased to serve you promptly.



DIAL

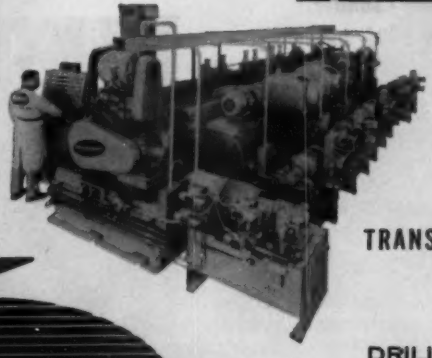


TRUNNION



SHUTTLE

SPECIAL



TRANSFER

TRANSFER
DIAL EQUIPMENT
TRUNNION
SHUTTLE
GUN DRILLING
TAPE CONTROL
DRILL HEADS
FIXTURES

Michigan

SPECIAL MACHINE CO.

11449 TIMKEN AVE. • WARREN, MICHIGAN

DRILLING
REAMING
TAPPING
SPOT FACING
CHAMFERING
COUNTER BORING
BORING
MILLING

Moore Jig Borer Has 3-Position Clutch

Replacing the No. 1, which was discontinued in 1955, this new Model No. 1½ is a popular-priced addition to the line. A special 3-position clutch (start, indicate, and brake), which is located for easy control by the operator, is an unusual feature of the new borer that is designed for working to split-tenth tolerances.

Other improvements of the No. 1½ over the No. 1 are: closer tolerances; infinitely adjustable spindle speeds from 120 to 2400 rpm, Vee and flat ways; 10½ x 19½-in. table with 16-in. height; two feeds instead of one; micro-setting of vernier dials; fast-to-set lead screws of 1⅜-in. Nitroloy; more weight (2300 vs 1700 lb); JIC conformity.

Positioning tolerances are approximately the same as the model No. 3.

Moore Special Tool Co, Inc, 800 Union Ave, Bridgeport, Conn

MORE DATA? Circle 78, inside back cover

Vertical Grinder/Sander Has Speeds to 8000 rpm

1600 Series, a combination unit which doubles as a grinder or sander, is a direct-drive governed model designed to handle a 6-in. cup wheel for medium heavy duty work.

Choice of three throttle arrangements is available. One is the butterfly on-and-off arrangement in which a detent holds the throttle on until it is turned off; second is the same type of butterfly valve but altered so that when the operator's thumb is removed the valve snaps to the off position. Third is a standard lever throttle. The dead handle is constructed so that its position can be changed from 90° to 120° from the throttle handle by rotating it. The handle can be removed entirely for close work. Speeds available are 4500, 6000, and 8000 rpm. Weight is 7½ lb. Guards available include rotating cup, stationary, and edge grinder.

Cleco Air Tools, Houston, Texas

MORE DATA? Circle 79, inside back cover

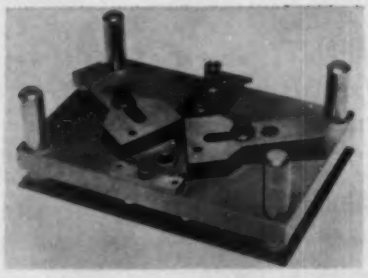
Drill Point for Circuit Boards Developed by Super Tool

Designated List 201-CB fractional size solid carbide circuit board drill and List 202-CB wire gage solid carbide drill, it is reported that exceptionally long life and ability to be resharpened many times enables the tool to manufacture hundreds of thousands of holes before it has to be discarded.

The company has set up a special department to re-point drills that are already in use. The new drill is furnished in various sizes from ¼ in. and below. Larger diameters can be manufactured.

Super Tool Co, Detroit, Mich

MORE DATA? Circle 80, inside back cover



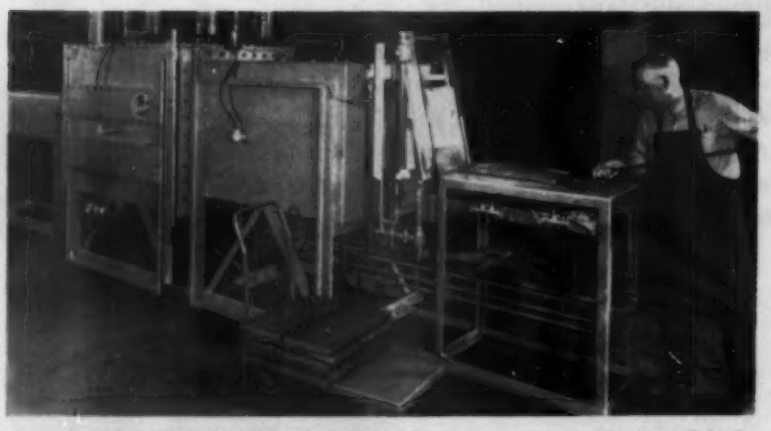
Stainless Steel Tool Components Offered in Expanded Line

Available from stock, for use in all precision machine jig, test fixture, and tool design applications, this coordinated line of individual parts and complete assemblies includes clamps, dogs, studs, spacers, washers, jig buttons, legs, heel pins, springs, and precision ground plates.

Round, square, or rectangular precision ground jig plates, in stainless steel for aluminum, are ground to a 32 micro-in. finish all over, with surfaces flat and parallel within a ± 0.0005 tolerance.

Pic Design Corp, 477 Atlantic Ave, East Rockaway, LI, NY

MORE DATA? Circle 81, inside back ocver



LINE OF BOX TYPE SINTERING FURNACES comes in 5 standard models for sintering and impregnating precision parts compacted from iron, iron-graphite, iron-copper, iron-graphite-copper, and copper, bronze, brass, steel powders. Burnoff chamber gives temperatures to 1500 F; high temperature chamber has heat up to 2350 F—*Harper Electric Furnace Corp, 110 Pearl St, Buffalo 2, N Y*

MORE DATA? Circle 82, inside back cover

CIRCLE 264 READER SERVICE CARD ►

new proven design

NēBEL

MICRO-TURN*

HIGH-SPEED PRECISION LATHE

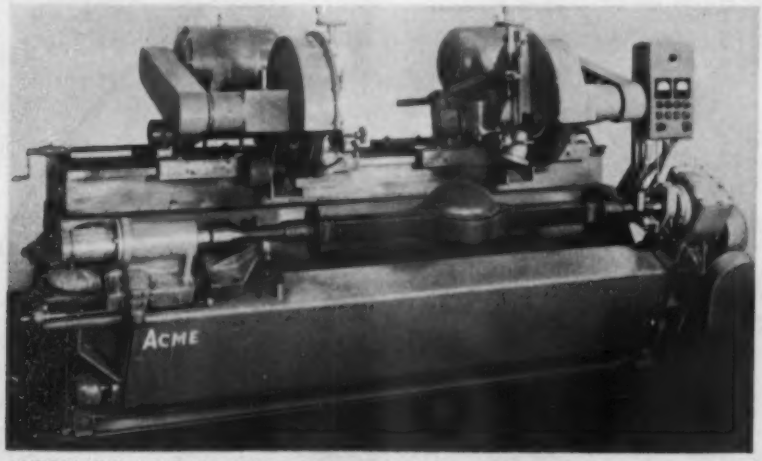
*TM

The entirely new Nebel MICRO-TURN Lathe combines the convenience of infinitely variable spindle speeds with the high efficiency of an exclusive new coaxial spindle. Designed around a single shaft surrounded by a planetary gear arrangement, the headstock provides outstanding structural benefits:

- **Low Inertia Effect for quicker acceleration and deceleration, prolonging clutch and brake life**
- **Simplified Alignment with fewer revolving parts for greater smoothness and efficiency of power transmission**

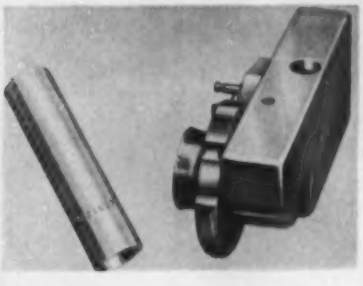
The MICRO-TURN Headstock is composed basically of two sections. The compact back-gear unit provides high reduction in minimum space, operates only on low speed range and presents maximum power at the spindle for rated horsepower up to 400 RPM. Above 400 RPM, the coaxial spindle sections lock into a single unit, reducing vibration and insuring a high degree of finish.

For complete details, write today for your copy of the new MICRO-TURN Bulletin No. 219. Nebel Machine Tool Corporation, Lathe Division, 3407 Central Parkway, Cincinnati 25, Ohio.



AUTOMATIC AXLE HOUSING GRINDER grinds weld flashing from square and non-cylindrical shaped axle housings. It can also be used to grind non-cylindrical shafts and bars. The two grinding heads are powered by 7½ hp motors—*Acme Mfg Co, Detroit, Mich*

MORE DATA? Circle 83, inside back cover



Marking Attachment Designed For Use on Screw Machines

The Rol-A-Matic is an automatic marker that can be used on screw machines and for light marking on turret lathes from one to six spindles. Consisting of only two moving parts, it can be attached to either front or rear cross-slide and is used for imprinting round, hollow, or solid stock. Price is $75.

Sossner Steel Stamps Inc, 161 Grand St, New York 13, NY

MORE DATA? Circle 84, inside back cover

Automatic Sequence Counter Fits Air-Operated Slide Feeds

Longer feed lengths are possible from Cooper-Weymouth slide feeds with the addition of this counter. By feeding longer lengths than rated capacities allow, the usefulness of the air feeds is extended, enabling one model to handle an infinite variety of feed length requirements.

In operation the sequence counter allows the air feed to advance the stock from one to seven times before the press is tripped. The 24-in. feed shown can automatically feed stock from 1 to 168 in. in length before the press is actuated. The counter can be wired directly into an air clutch control panel or, with the addition of an air cylinder, can operate a mechanical clutch press.

Cooper-Weymouth Inc, 600 Honeyspot Rd, Stratford, Conn

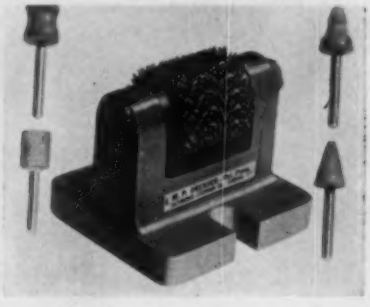
MORE DATA? Circle 85, inside back cover

Hoover Pillow Block Bearings Offered in New Narrow Width

EDX pillow block and FEDX flange units for light and medium duty service have a redesigned lip type seal for improved retention of lubricant (that lasts for the life of the bearing) and exclusion of dirt. Eccentric locking collar secures the inner bearing ring to the shaft. These bearings are available in a wide range of shaft sizes from ½ to 1 3/16 in. Made with Hoover honed raceways and Micro-Velvet balls, they are completely interchangeable with the company's ED and FED units and offer the same load capacity.

Hoover Ball & Bearing Co, 5400 S State Rd, Ann Arbor, Mich

MORE DATA? Circle 86, inside back cover

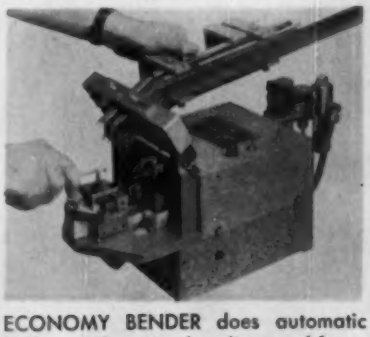


Dresser Restores Shape Of Abrasive Mounted Points

Grinding wheel dresser is designed to restore the shape and grinding action of worn, loaded, and out-of-shape points. The revolving mounted point is held against the thin gage star type cutters for a few seconds until the original shape appears. Dresser base is 3 x 3¼ in. and may be bolted or screwed to a bench. Shipping weight is 2½ lb.

Desmond-Stephan Mfg Co, Urbana, Ohio

MORE DATA? Circle 66, inside back cover



ECONOMY BENDER does automatic high-speed cutting, bending, and forming of resistor and diode leads. Designed especially for preparation of components for printed circuit boards, it features adjustable card feed chute for rapid loading of components, stellite tipped cutters, adjustable speeds, and an air filter regulator lubricator at no additional cost. Price is $650—*Design Tool Co, Div Federal Mfg & Engrg Corp, 1055 Stewart Ave, Garden City, N Y*

MORE DATA? Circle 87, inside back cover

it's yours in the Niagara line

A BIGGER PRESSFUL OF PERFORMANCE

- Rigidly built, all-steel frames of patented, triple box section design.
- Box-type, welded steel slides reinforced with heavy webbing.
- Extra-long, adjustable gibs that fully contain the slide during working stroke.
- Laminated, non-metallic ways . . . an exclusive Niagara press feature to prevent scoring.
- Low-inertia pneumatic friction clutch and brake for trouble-free, high production.
- Centralized pressure lubrication.
- Operating controls conveniently arranged on master panel.
- Unusually liberal shutheight and extremely long slide adjustment to accommodate a wide range of stamping and forming dies.

TWO-IN-ONE FLEXIBILITY

Here's a 250-ton Niagara Straight Side Double Crank Press, at contract metal stamping plant of Belmet Products, Inc., equipped with:

1 Roll feeds for progressive die work on coil stock.

2 Nine-station transfer feed mechanism and dies for work with pre-cut blanks . . . quickly removable as a self-contained unit.

Progressive die stamping . . . deep drawing . . . heavy blanking . . . lamination punching . . . you name it! Niagara Straight Side Single and Double Crank Presses are the profitable choice for numerous stamping requirements. No other line can match them in the middle capacity range. Once you've checked their operating and structural features, it's easy to see why.

Built in a combined range of 50 through 500-ton capacities, Niagara Series SC-1 and SC-2 Presses are available in non-geared, single geared or double geared models, with either single or twin-end drives. All can be outfitted with automatic feeds, adjustable speed drives, pneumatic die cushions, special controls and devices for automation.

Learn how you can get "a bigger pressful of performance." Be prepared for the next time you buy a straight side — single crank or double crank. Write for illustrated Bulletin 64. ***Niagara Machine & Tool Works, Buffalo 11, N. Y., District Offices and Distributors Everywhere.***

NIAGARA straight side presses

SINGLE AND DOUBLE CRANK

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work.

CIRCLE 265 READER SERVICE CARD

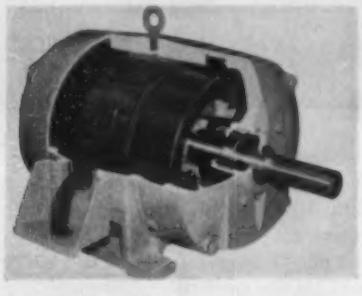
Westinghouse Offers AC Welder For General Heavy Fabrication

Known as the TC, the basic unit is a single-phase, transformer-type ac welding power source. It is built to operate from 230/460 v primary and is NEMA rated as a 500-amp machine.

Welder has an open circuit voltage adequate for excellent starting with any ac stabilized electrode. A wide variety of factory installed optional equipment can be added if required. It has been designed particularly for use in shipyards but it has broad applications for ac welding in the transportation industry and construction trade as well as for general heavy fabrication.

Westinghouse Electric Corp, West-Ing-Arc Dept, PO Box 2025, Buffalo, NY

MORE DATA? Circle 88, inside back cover



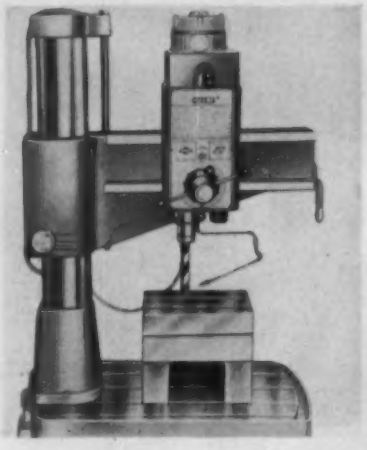
New Motor Line Announced by Howell

Howellsealed encapsulated motors, 3 or 2-phase, 1 through 125 hp ac squirrel-cage, provide open motor performance for applications usually requiring enclosed units. Howellseal is a specially developed epoxy compound applied under vacuum to surround each wire in slots and at coil ends to produce a solid, void-free mass. These motors are reported to have the high overload service features of standard open units and, at the same time, provide the winding protection of enclosed motors at a 10% to 30% lower cost, depending upon size.

Units are available in NEMA designs A, B, C, and D for 1, 2, 3, or 4-speed constant or variable torque operation, all standard voltages and frequencies.

Howell Electric Motors Co, 16316 W Seven Mile Rd, Detroit 35, Mich

MORE DATA? Circle 89, inside back cover



Mecof Radial Drills Feature Pre-Selective All-Geared Heads

These 8 x 30-in. and 12 x 48-in. radial drills, made in Italy, feature pre-selective type all-geared heads, and at the regular price incorporate numerous additional features and equipment which usually cost extra. Drilling capacity is 1 and 1 3/16 in. in steel, and 1⅜ and 1⅝ in. in cast for the 8 and 12-in. column machines respectively. Twelve pre-selective speeds and six rates of tool feed adapt these radials to a wide range of work.

Dist by Boice-Crane Co, 935 Central Ave, Toledo 6, Ohio

MORE DATA? Circle 90, inside back cover

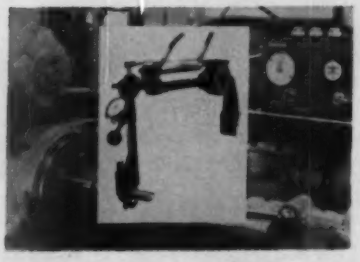
Hydraulic Feed Unit Has Adjustable Stroke up to 4 in.

Attachment, designated the Empco HF-425 Hydro-Feed, for simplified control of complex machining operations, operates independently or in conjunction with other hydraulic equipment such as clamps, indexing mechanisms, or other feed units. Pressure-compensated feed valves permit a flexible range of operational cycles and, due to the fine adjustment possible, the unit can be used in a variety of production operations including reaming, counterboring, grooving, tapping, and other applications that require an even feed in any part of the stroke.

The unit has a 5/16-in. diameter drilling capacity in medium steel with adjustable stroke up to 4 in. For use with up to ¾-hp motor, maximum speed is 3000 rpm. Maximum hydraulic line pressure is 500 psi with 700 lb of thrust for each 300 psi. Standard equipment includes a ¾-in. ID spindle nose.

Enterprise Machine-Parts Corp, 2732 Jerome St, Detroit 12, Mich

MORE DATA? Circle 91, inside back cover



Plunge-Grind Output Increased By Hydraulic Actuator

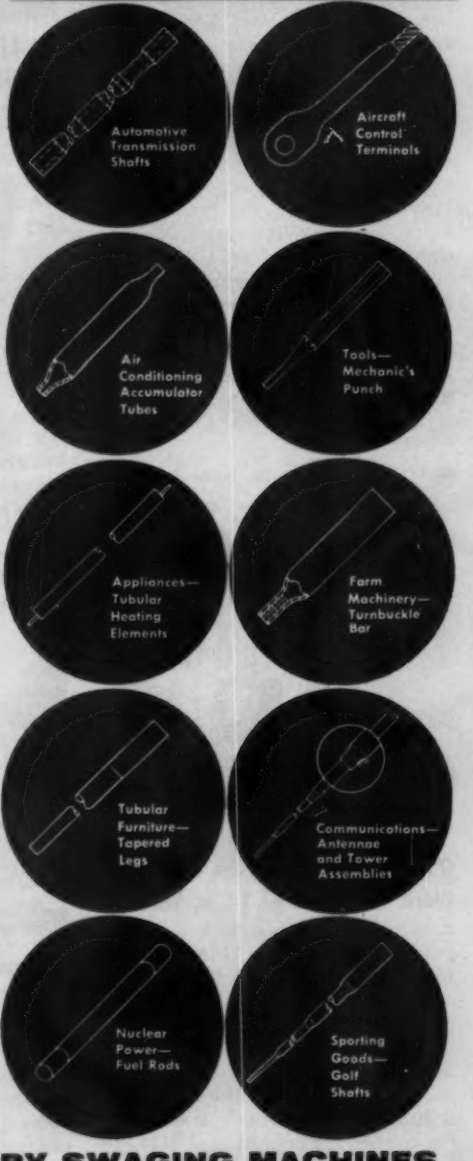
Federal-Arnold actuator is a hydraulically operated device for automatic positioning and retraction of a continuous grinding gage. It reportedly increases both the output and quality of plunge-grind operations because it allows the operator to control two or more machines and makes it impossible for him to overlook using the gage on any workpiece.

Device, consisting of a ball-bearing mount and a support arm working in conjunction with a single hydraulic cylinder and a cam-actuated rod, carries the caliper to a position in front of the work. Then, through cam action, the caliper is brought into gaging position. At the end of the cycle the action is reversed and the gage is returned to its rest position. The actuator can be operated by the grinder hydraulic system directly or may be signalled in by external means at some other time of the cycle.

Federal Products Corp, 1144 Eddy St, Providence 1, RI

MORE DATA? Circle 92, inside back cover

WHAT TORRINGTON ROTARY SWAGING MACHINES CAN DO FOR YOU

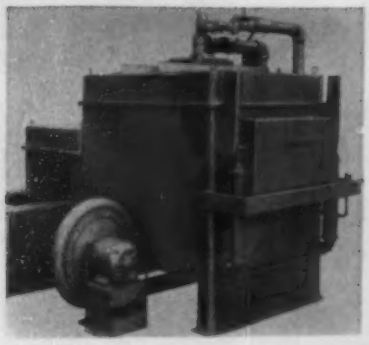


These versatile, efficient machines shape metal parts by hammering between dies instead of cutting stock away. They give you a full pound of parts from every pound of metal. They also save you time and labor. Swaging is usually the fastest way to point, taper, reduce or bond metal parts. Tooling is simple and surprisingly inexpensive.

There is no greater authority on swaging than Torrington. Torrington pioneered the swaging process, designed the original equipment and has constantly improved it through innovations in methods and engineering. Today, Torrington operates more swaging machines than any other company in the world. The experience of our engineers is unparalleled. We maintain experimental shops to help you solve your special swaging problems. If you have a part that can be swaged we can design and produce "Job-Tested" dies to your specifications. Come to Torrington with your swaging problems—we have the answers. The Torrington Company, Swaging Machine Division, 200 North St., Torrington, Conn.

progress through precision **ROTARY SWAGING MACHINES**

THE TORRINGTON COMPANY Torrington, Conn.



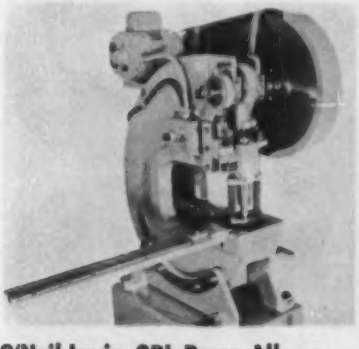
2-Chamber Dry Hearth Furnace Is Gas, Oil, Combination Fired

A complete new line of double chamber dry hearth aluminum melting and holding furnaces consists of three furnace types designed for use in aluminum sand casting, die casting, and permanent mold plants. All three are of single unit construction with individual metling and holding chambers. Either gas, oil, or combination fuel fired, the furnaces feature separate firing systems in each chamber to assure rapid melting in one chamber and correct holding temperature in the other.

Depending on size and type, these furnaces can melt from 250 to 2000 lb of aluminum an hour with holding capacities to 2000 lb.

Heavy Duty Electric Co, Milwaukee 1, Wis

MORE DATA? Circle 126, inside back cover



O'Neil-Irwin OBI Press Allows Work to Center of 24-in. Sheet

A new five-ton open back inclinable punch press with a 12-in. depth of throat allows working to the center of a 24-in. sheet. Called Di-Acro punch press No. 5, the machine can be used for high-speed production operations.

Flywheel speed is 210 strokes per min, and the machine can be set up for continuous operation at this rate by removing the cam from the trip mechanisms. Practical rate for single stroke cycling of the press would be 150 strokes per min.

O'Neil-Irwin Mfg Co, 512 8th Ave, Lake City, Minn

MORE DATA? Circle 127, inside back cover

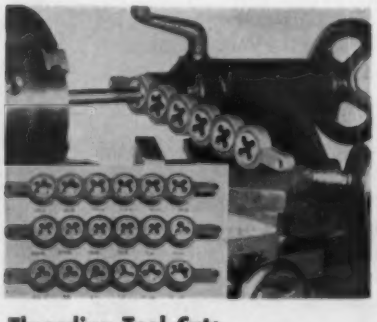
Can-Lifter Magnet Speeds Handling of Light Materials

Permanent magnet for lifting cans and other light materials incorporates a manual discharge mechanism that releases the load. Operator simply presses a pair of handles which, in turn, push a stainless steel coverplate away from the face of the magnet. The load is then forced out of the magnetic field and released from the unit.

Unit shown, handling battery cases, measures 18 x 20 in. and contains Indox ceramic permanent magnets. These magnets are offered in a number of sizes and shapes to conform to various sizes of containers or conveyor belts. Different types of release mechanisms are also furnished to fit variety of requirements.

Stearns Magnetic Products, 635 S 28th St, Milwaukee 46, Wis

MORE DATA? Circle 128, insid back cover



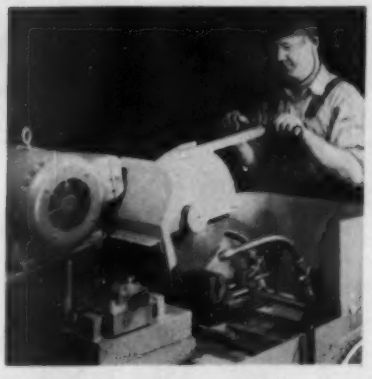
Threading Tool Cuts 18 Different Sizes

Tool will cut 18 different thread sizes from ⅛ to ½ in. in USS and SAE, plus ⅛ and ¼-in. pipe threads. Dies are permanently mounted in three tools (six dies in each) and are always ready for use. Special feature of the tools is that the face of each die is parallel with the back of the holder, simplifying the cutting of threads on any lathe, pipe machine, drillpress, or by hand.

Holder is made of high-strength aluminum. Dies are split adjustable, made from alloy tool steel, and secured in the holder by three Allen cone point screws. Set of three holders with 18 different size dies is priced at $39.

Mohr Tool & Mfg Co, Box 630, Maywood, Ill

MORE DATA? Circle 129, inside back cover



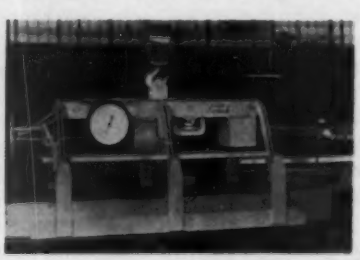
Tool Reclamation Speeded By Cut-Machining

Flexi-Modular cutting units, added to Wallace line, reportedly clean cut on the hardest high speed tool steels. Cuts are produced with no measurable metallurgical change in the hardened tools being cut. Switching from one job to another can be done swiftly.

Use of 14-in. wheels reduces number of wheel changes. Wheels are rubber, operate wet, and at starting speeds of less than 10,000 sfm. Six to ten seconds should be allowed for each square inch of tool steel being cut.

Wallace Supplies Mfg Co, 1300 Diversey Prkwy, Chicago 14, Ill

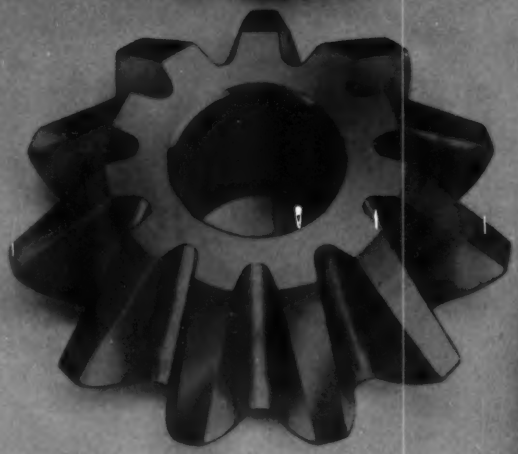
MORE DATA? Circle 130, inside back cover



C-F SHEET LIFTER is available with built-in automatic hydraulic weighing attachment. Eliminates need for headroom as is required by conventional crane scale—*Martin-Decker Corp, 3431 Cherry Ave, Long Beach 7, Calif*

MORE DATA? Circle 131, inside back cover

CIRCLE 267 READER SERVICE CARD ►



THE Gleason Revacycle® method and its machine present the fastest way known for cutting precise straight bevel gears.

The Revacycle cutter holds roughing, semifinishing, and finishing blades. One revolution of the cutter completes a tooth space in 2.5 seconds. In fact, on smaller pieces, you can complete as many as four tooth spaces with a single cycle . . . that's less than ½ second per tooth!

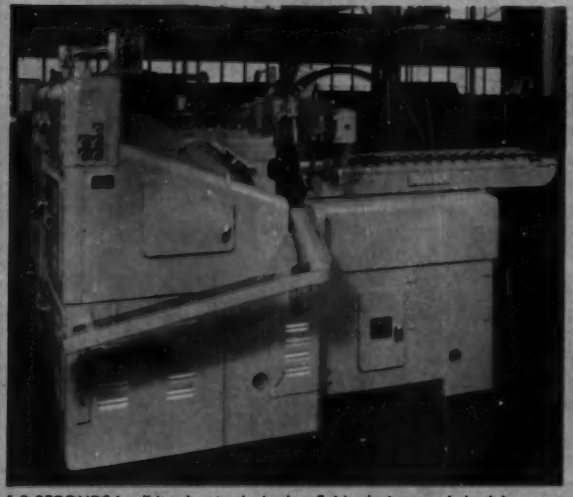
This completely automatic Gleason machine can frequently replace a tandem of roughing and finishing machines . . . thereby saving considerably on capital investment.

Best of all, to get this speed and economy you need sacrifice nothing in accuracy. The Revacycle method produces localized tooth bearing which permits any practical assembly tolerances while avoiding load concentration at the ends of the teeth. And, you get exact reproduction piece after piece, day after day.

The machine accepts a wide range of work: diameters up to 10" at a 5 to 1 ratio and face widths up to 1.25".

For complete background and data, write for a bulletin. Gleason engineers will help you with details on any specific applications.

How to cut a bevel gear tooth in 2.5 seconds



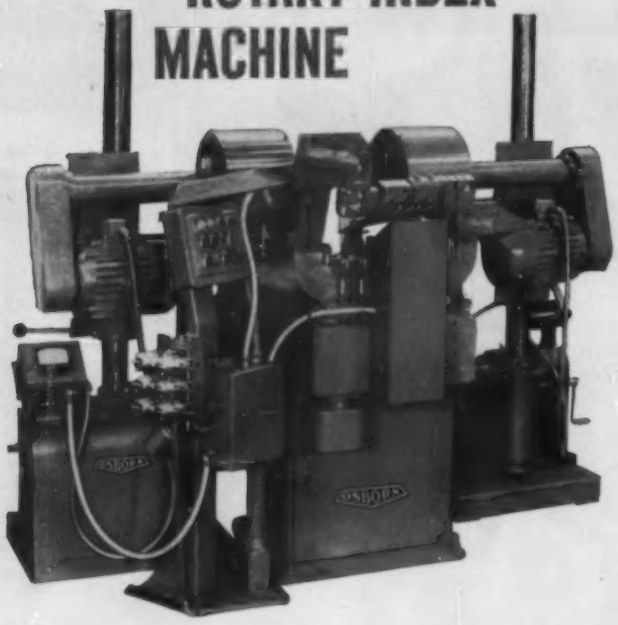
1.2 SECONDS is all it takes to dechuck a finished piece and chuck in a new blank with the automatic loading attachment on the 109 Revacycle Machine.

GLEASON WORKS

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

to cut your metal finishing costs—

OSBORN AUTOMATIC ROTARY INDEX MACHINE



features "building block" components arranged for completely automatic finishing cycles

An automatic part load/unload and turnover mechanism is the latest addition to Osborn's Rotary Index metal finishing units. This feature eliminates the need for production machine operators—and means regulated work flow plus higher production rates.

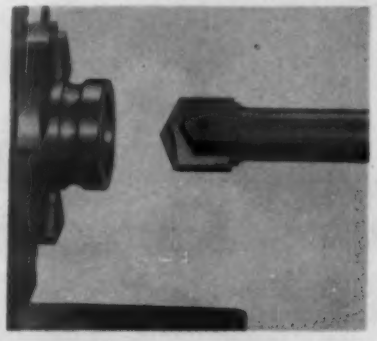
Most significant feature is the use of a *standard* index table and *standard* finishing heads easily tailored for efficient, economical *automated finishing* operations.

Other advanced design and construction features make these Osborn Metal Finishing Machines worth your immediate investigation.

Your Osborn field specialist has latest application data on a wide range of cost-saving finishing methods. An Osborn Analysis—made in your plant now at no cost or obligation—is the first step to pinpoint savings in *your* operations. Write or call *The Osborn Manufacturing Company, Dept. C-105, Cleveland 14, Ohio. Phone ENdicott 1-1900.*

OSBORN®

Metal Finishing Machines . . . and Finishing Methods
Power, Paint and Maintenance Brushes • Foundry Production Machinery



Madison Spade Drills Make Holes In One Pass From the Solid

Capable of making holes in one pass, with no need for progressive drilling in deep holes, the drill forms a small C-shaped chip that can be easily flushed from the work. A wide range of bit sizes are interchangeable in a Madison toolholder. The drills can be used in a radial drillpress, turret lathe, automatic ,or similar types of shop equipment. Holders need not be removed for regrinding; the cutters are simply replaced right on the machine.

Madison Industries Inc, PO Box 1137, Providence, RI

MORE DATA? Circle 93, inside back cover

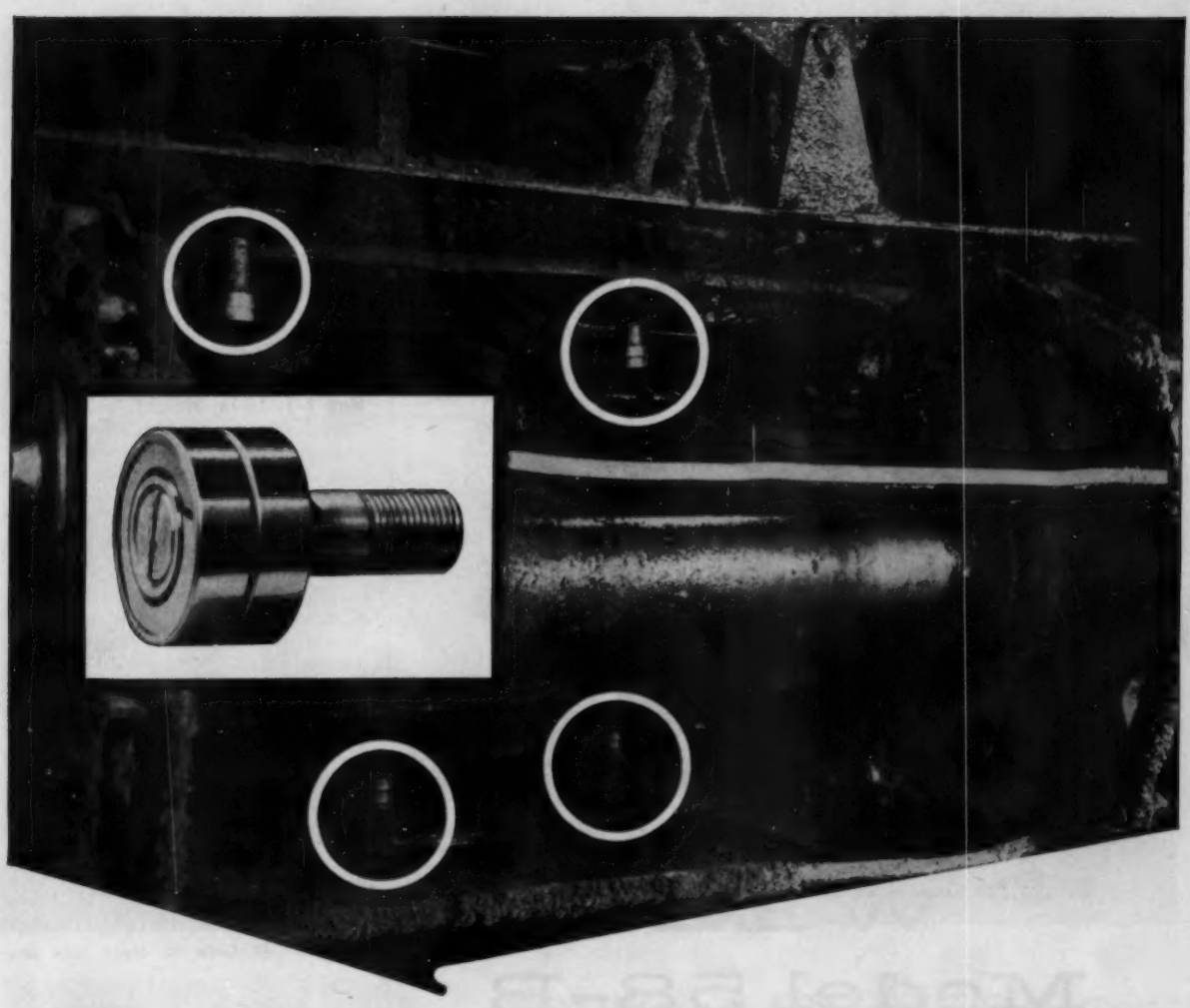
Bench Shear and Rod Cutter Takes Stock up to 3/32-in.

Called the Kar-y shear and rod cutter, this bench tool can cut bar stock up to 3/32-in. thick and rods up to 5/16-in. dia. Unlike other tools of this type, it has a back action which permits the operator to clearly see the guide line on which the blades are cutting. The tool can be used for production purposes as well as for tool and die work.

Price of the cutter, complete with high grade tool steel blades, is $45.

E V Nielsen Inc, 575 Hope St, Stamford, Conn

MORE DATA? Circle 94, inside back cover



When thrust loads overpowered original bearings... Bearings, Inc. had the answer!

The original bearings on this automatic machine failed after a short time because they weren't designed to take the thrust loads to which they were subjected. Bearings, Inc. engineers designed and had built a special stud on which were mounted two permanently lubricated and sealed ball bearings.

To keep the cost of this design to a minimum "Locktite", a permanent bonding agent, was used to hold the bearings to the stud. This eliminated shoulders, locknuts or rings yet the bond is as strong as the best press fit.

This installation has now been in operation for many months with no failures reported.

This is not an isolated example of our services — surveys of bearing requirements, inventory control, application engineering, maintenance schedules and procedures are a regular and continuing part of our service to all customers to whom we supply replacement bearings.

Tell us how we can help YOU!

**A recent acquisition*

Providing bearing service in the North →

BEARINGS, INC.

OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Lockland • Mansfield • Painesville • Toledo • Youngstown Zanesville • **INDIANA:** Ft. Wayne • Indianapolis • Muncie • Terre Haute • **PENNSYLVANIA:** Erie • Johnstown • Philadelphia • Pittsburgh • York **WEST VIRGINIA:** Charleston • Huntington • Parkersburg • Wheeling • **NEW JERSEY:** Camden • Newark • **NEW YORK:** Bolanrol Corp., Buffalo • Niagara Falls • **MARYLAND:** Baltimore • **DELAWARE:** Wilmington
***NEIMAN BEARINGS DIVISION,** St. Louis, Mo., E. St. Louis, Ill.

and

in the South →

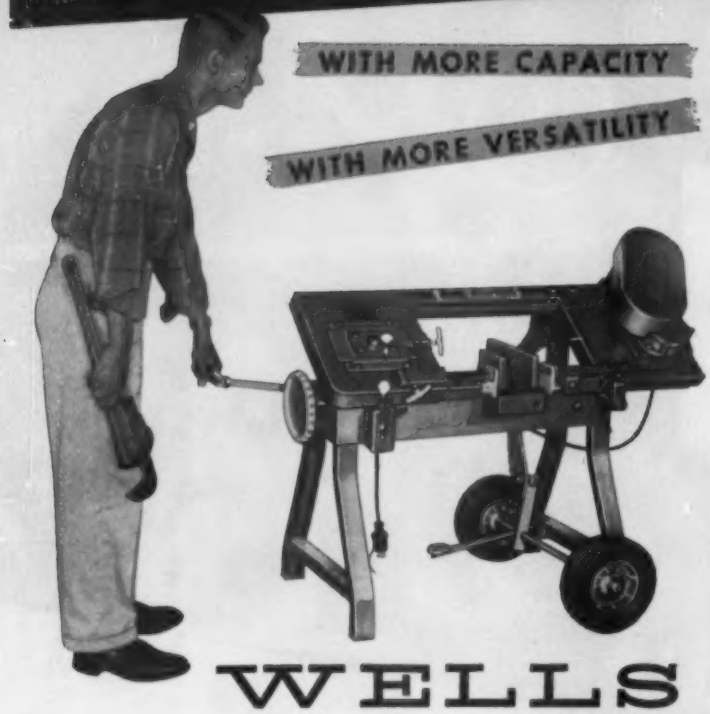
DIXIE BEARINGS, INC.

ARKANSAS: Little Rock • **FLORIDA:** Jacksonville • **GEORGIA:** Atlanta • **KENTUCKY:** Louisville • **LOUISIANA:** Baton Rouge New Orleans • **N. CAROLINA:** Charlotte • Greensboro • **S. CAROLINA:** Greenville • **TENNESSEE:** Chattanooga • Kingsport • Knoxville Memphis • Nashville • **VIRGINIA:** Norfolk • Richmond • Roanoke

A NEW, COMPLETELY MOBILE CONVERTIBLE BAND SAW

WITH MORE CAPACITY

WITH MORE VERSATILITY



WELLS Model 58-B

Here's a compact, convertible band saw designed for shop or "job-site" work . . . the Wells Model 58-B. It provides the capacity you've been looking for . . . at a modest price. Equipped with optional wheel/handle unit, the Model 58-B becomes completely mobile . . . easily rolls from job to job. Use the 58-B as a horizontal cut-off machine (capacity: 6" x 10") or swing the head to upright position, install work table and it's a utility vertical band saw. For complete details on this double duty—double value band saw, see your Wells Distributor or write for Bulletin 262.

SPECIFICATIONS

Capacity:	
Rectangular	6" x 10"
Round	6" Diameter
45° Angle	5" x 5"
Speeds, f.p.m.	76—141—268
Blade Size	½" x .025" x 93"
Motor	⅓ H.P.
Width of Bed	8½"
Floor to top of Bed	22¼"
Floor Space	19" x 47"
Height (Frame Vertical)	52"
Height (Frame Horizontal)	37"
Vertical Capacity:	
Work Table	7¾" x 10"
Throat Height	9½"
Throat Depth	7¾"
Net Weight (Approx.)	220 lbs.

Wells CBMC

Wells

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION

2700 Pine Street, Three Rivers, Michigan

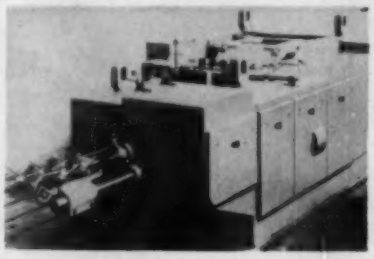
4-in. Rotary Table Has 1-3/16-in. Height

This accessory for circular milling, engraving, or graduating work, has a 4-in.-dia worktable that has a ⅜-in.-24 threaded center hole with ⅝-in. counterbore and twelve 10-32 tapped holes for securing workholding devices.

Top surface has concentric circles machined on 1, 2, and 3-in. diameters to aid in location of workpieces. Table top rotates through 360° and has an accurately graduated scale with direct readings to one degree and to one minute with the vernier. Table can be locked in working position with thumbscrew, permitting quick changes to be made. Assembly is mounted by means of hold-down screws through slots in base flanges. Price is $47.50.

Micro Instrument Co, 80 Trowbridge St, Cambridge, Mass

MORE DATA? Circle 95, inside back cover

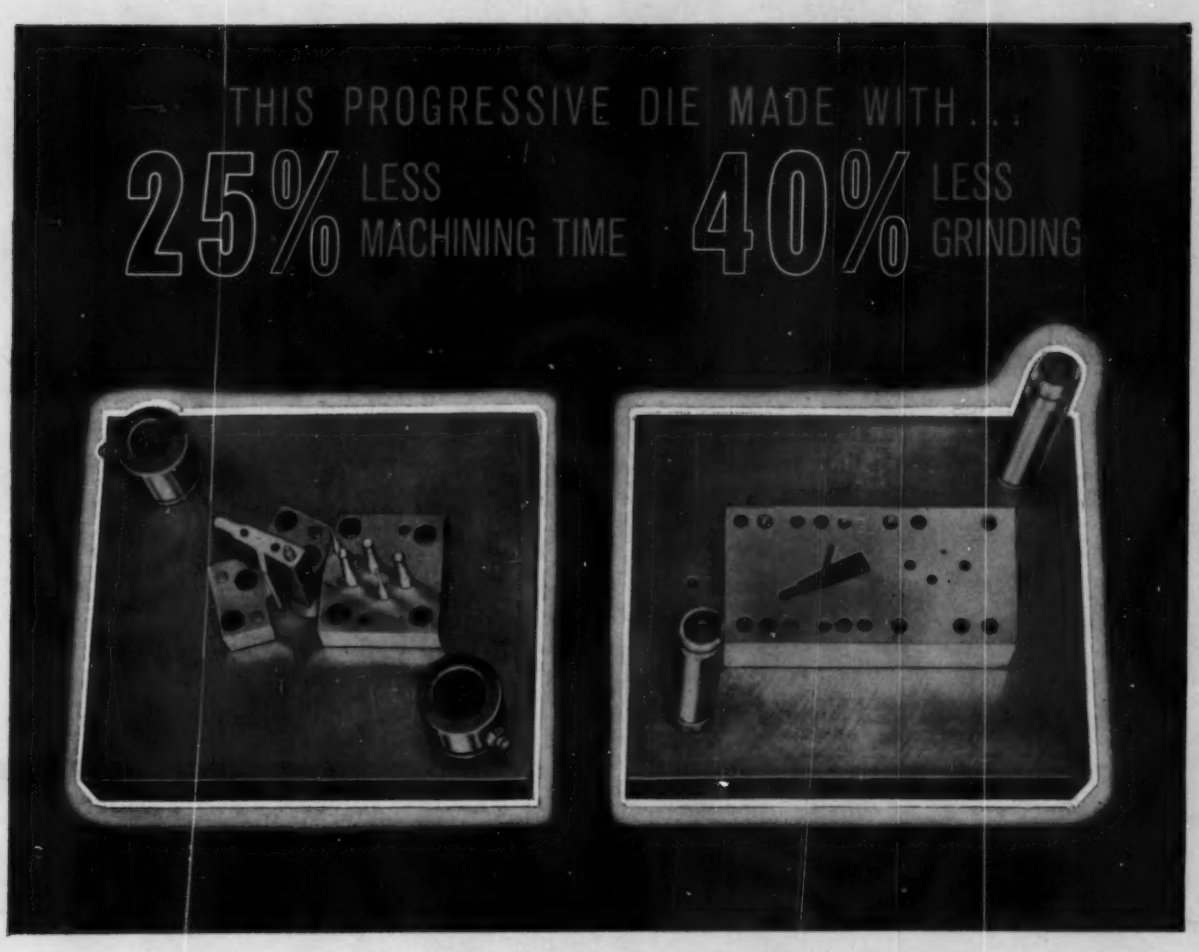


Automatic German Cold Transfer Press Is Made in Four Sizes

This new automatic cold transfer press, which is manufactured by Malmedie & Co (Germany) in four sizes, is particularly designed for the efficient mass production of bright-pressed nuts and similar components made of round stock. It has one shearing station, five press stations, and a fully automatic draw-in control which ensures uniform cut-offs independent of the index timing. Brief resetting times can be achieved by using pre-assembled tool sets and easily disengaged feed mechanisms.

Dist by Straus-Artys Corp, 45 N Station Plaza, Great Neck, N Y

MORE DATA? Circle 96, inside back cover



LO-AIR TOOL and DIE STEEL

*Low Temperature - Air Hardening**

. . . CUTS PRODUCTION COSTS

Accurate Machine and Tool Company of Roselle Park, N.J., reports savings of 40% in grinding and 25% in machining time on this progressive die—through the use of LO-AIR, the tool and die steel that is easy to machine —has least distortion in hardening.

On oil hardening tool steels, previously used for this die, .015" was allowed on sides for grinding and .005" in jig bored holes before heat treating. With LO-AIR they found it safe to allow not more than .0025" on sides and no extra in holes before hardening—making great savings possible.

For complete information, write today for Performance Report No. 20. Also, we will gladly send you a copy of our 12-page LO-AIR brochure on applications, properties and other technical data. For immediate delivery of LO-AIR, call our nearest sales office or warehouse. Complete stocks available.

**U.S. Pat. No. 2,355,224*

UNIVERSAL CYCLOPS
STEEL CORPORATION
EXECUTIVE OFFICES: BRIDGEVILLE, PA.

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

WHICH NEW GEAR PROCESS WILL YOU HELP CREATE

Every new gear production process "we" pioneered in the last 3 or 4 decades—and there have been many—had its origin as a problem faced by one or more people like yourself—men who recognized the existence of a problem and came to Michigan Tool for the answer.

Lets go back to 1925 when automobile transmissions were so noisy that drivers couldn't hear themselves think over 30 miles an hour. Sales complained to management, management to engineering, engineering to manufacturing. They finally came to us and we put our engineers and research laboratory to work. You know the answer—gear shaving and the equipment that made quiet gears practical and economical.

Since those days, "Gear Production Headquarters" has poured out a steady stream of answers to the problems of men like yourself—answers like Shear-Speed gear shaping to make the cutting of toothed parts possible at high speeds; Roto-Flo cold rolling of all kinds of splines, threads and grooves in seconds instead of minutes—stronger and better than if machined; optical sine-line gear checking for either laboratory or on-the-floor control; Gear-O-Mation devices for automatic parts handling in process; double enveloping gearing to carry bigger loads with smaller gears; Ultra-Speed hobbing; hard gear finishing; giant shavers and hobbers to turn out gears up to 20 feet in diameter to almost unbelievable precision toler-

Michigan Tool Company

?

ances to make ship drives quiet to protect against submarines; grinding equipment to make even "spherical" gears.

To make some of the new processes work even better we created new tools, new coolants; new plastics for gear hones, indexing tables which divide a circle into 5 million parts accurate to a fraction of a second; even text and reference books to make gear designing easier.

You too must have a problem . . . large or small . . . about processes, machines or even tooling. Perhaps our experience has already provided the answer. If we don't have it, we'll go to work on it. Chances are we'll come up with it as we have so often before. It's worth trying and *your* Company will benefit.

7171 E. McNICHOLS ROAD • DETROIT • TW 1-3111

Plants in: Detroit, Traverse City and Manistee, Mich. and Windsor, Ontario.

Gear Production: The most complete line of equipment for gear production offered by any manufacturer.

Hobbers and Shapers for Job Lots
High Production Hobbers
Shear-Speed Gear Shapers
Roto-Flo Cold Forming
Shavers for gears of ½" to 200"
Internal and External Form Grinders
Sine-Line Gear and Tool Checkers
Gear Chamfering Equipment
Abrasive Gear Finishers
Mitco Quality Gear Cutting Tools

Automation Equipment (Gear-O-Mation Division): Engineering and manufacture of simple and practical equipment for automating a plant, a line, or a machine. Pre-engineered units for orienting, storage, loading, unloading, assembling, conveying, escapements, positioning, elevating, feeding.

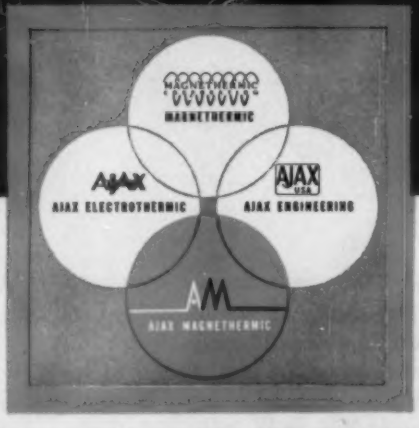
Form Grinding (Gear Grinding Machines Division): "Detroit" fully automatic form grinders for both external and internal contours—involute, cycloidal, spherical, straight sided.

Prototype Gearing (Enterprise Division): Spur, helical, bevel gears and splines for prototypes and in developmental quantities. Also contour form grinding, internal and external.

OTHER MICHIGAN TOOL DIVISIONS INCLUDE:

Cone-Drive Gears Division (double-enveloping worm gears, speed reducers, gear motors); Michigan-Lorenz Division (hobbers and shapers); Shear-Speed Chemical Products Division (coolants and cutting oils); Colonial Tool Co. of Canada Ltd. (cutting tools of all types).

These twin 1000-lb. melting furnaces prepare copper for metal powder at the St. John's, Michigan, plant of Federal-Mogul-Bower Bearings, Inc.



WATCH AM

FOR THE NEW IDEAS IN HEATING AND MELTING BY INDUCTION

Copper Melting Furnaces, one of many products of AM, for the heating or melting of metals by Induction.

"induction heating is our only business"

AJAX Magnethermic CORPORATION

GENERAL OFFICES
P. O. BOX 839
Youngstown 1, Ohio

TRENTON DIVISION
930 Lower Ferry Road
Trenton 5, New Jersey

YOUNGSTOWN DIVISION
3990 Simon Road
Youngstown 1, Ohio

1% Switchboard Instruments Added to GE Line

New element and case design of these 1% accurate ac voltmeters and ammeters has made it possible for GE to price them up to 22% below other models. Designated Type AB-30, the new line has the same 5.1-in. scale length as the Type AD-7 rectangular switchboard instrument. Its flange dimension, however, is only 4¼ in. sq compared to the 6½ x 7-in. dimension of the AD-7. The AB-30 has a 180° scale.

Normal rating for ammeter models is 5 amp; other self-contained ratings are available from 1 to 30 amp. Standard voltmeter ratings are 150, 300, 500, and 600 v.

General Electric Co, Schenectady 5, NY

MORE DATA? Circle 97, inside back cover

Chamfering and Deburring Tool Incorporates New Lip Form

Roto-Burr grind produces a tool that will curl the chip up and away from the work. This eliminates forcing any metal into the edge of the opening or causing a ridge to be formed around the opening. Tool is made of M-2 HSS, hardened and then treated to a special Jancy process that reportedly eliminates much of the galling common to all cutting tools. It can be furnished singly or in sets.

Jancy Engrg Co, 508 S Pine St, Davenport, Iowa

MORE DATA? Circle 98, inisde back cover

BRAD FOOTE gears ...FOR A WORLD AT WORK

SPIRAL BEVEL GEARS

for precision mechanisms and heavy duty power transmission

above • BRAD FOOTE 60" Spiral Bevel Gear Generator cutting the teeth in gear for heavy duty oil drilling rig

left • Power testing the same gear with mating pinion in BRAD FOOTE Gleason testing machine. Note the localized central-toe bearing produced to facilitate ease of assembly.

BRAD FOOTE offers the finest cutting and testing equipment available for the production of precision spiral bevel gears in the widest range of capacities.

These include such diversified drives as: spiral, zerol, right angle, obtuse or acute angle. They may be in sizes from 1" to 60" diameter, 10 DP to 1 DP and from ½" face to 10" face.

For precision mechanisms or heavy duty power transmission, BRAD FOOTE builds your gears from blanks to finished product...fills all your requirements from *one source.*

ORDER FROM BRAD FOOTE

Your order for BRAD FOOTE Gears will be processed by an experienced organization of gear specialists and produced on the most extensive and versatile facilities available. Maximum performance and your complete satisfaction are assured because no one shares our responsibility.

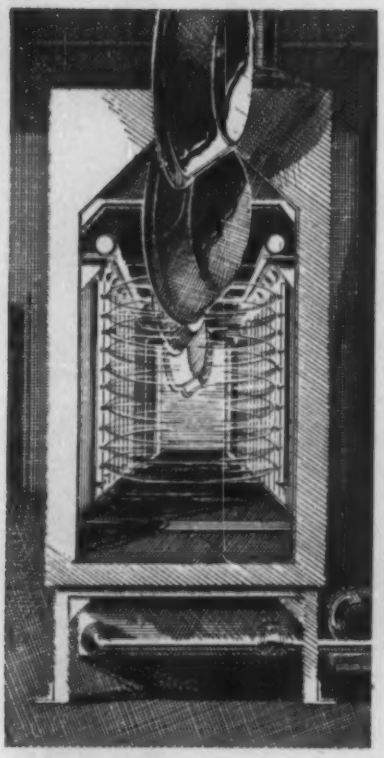
OTHER BRAD FOOTE SPECIAL EQUIPMENT INCLUDES: High Precision Rack Broaching Machine with capacity up to 1 DP; 134" Precision Gear Shaper; 72" Diameter Shaving Machine

MEMBER OF AGMA

BRAD FOOTE GEAR WORKS, INC.

1301 South Cicero Avenue • Cicero 50, Illinois • Bishop 2-1070 • OLympic 2-7700

subsidiary • PITTSBURGH GEAR COMPANY, Neville Island • Pittsburgh 25, Pa., Phone: SPaulding 1-4600



Don't overlook

DeVilbiss power spray washers

DeVilbiss automatic parts washers clean faster and more thoroughly because they're engineered specifically for the job—for continuous conveyor operation or batch-type work. Units available in both standardized and custom designs to meet your exact operating problems. Send for Catalog 1101, or contact your local DeVilbiss representative for a specific recommendation and prompt quotation. The DeVilbiss Company, Toledo 1, Ohio. Offices in principal cities.

FOR TOTAL SERVICE, CALL
DEVILBISS

NEW SHOP EQUIPMENT

LP-Gas Outfit Can Be Converted For Use With Acetylene

Cutting-heating-welding-brazing outfit specifically for use with LP-gas is known as Big 98LP and is a companion to Big 98 which has been on the acetylene market for two years. Basic component parts are interchangeable for use with acetylene; it can be converted by adding acetylene cutting or welding tips.

The outfit contains a new braze-welding tip which makes it completely functional for use with LP gas. This tip does fusion welding of metals up to 14 gage and does an outstanding job of brazing on any thickness, according to manufacturer. The LP cutting tip included cuts up to 4-in. metal and the cutting assembly accepts all of the tips in the company's line. There is also a mid-range soldering tip and adapter for use with LP-gas and air; Smith's complete line of air LP-tips can be used with this adapter.

Smith Welding Equipment Corp, 2633 Fourth St SE, Minneapolis 14, Minn

MORE DATA? Circle 99, inside back cover

ALUMINUM-HEADED HAMMER is furnished in three weights: 13 oz; 1 lb 10 ozs; and 2 lb 1 oz. Hammerhead transmits blow without rebound; head is said to be non-marring, non-sparking, non-chipping, non-spalling. It is fitted with a hickory handle—*Frank N Wood Co, Waukesha, Wis*

MORE DATA? Circle 100, inside back cover

Invented by **THOMSON**

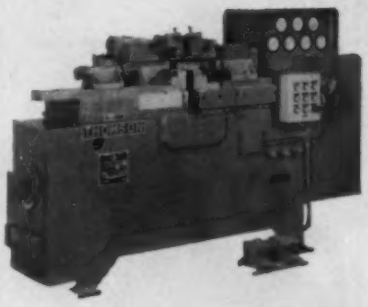
Perfected by **THOMSON** *Resistance Welding*

Spot • Projection • Seam
• Press • Flash-Butt
• High-Frequency

plus EXCLUSIVE

Synchro-matic and Synchro-shear*

... for jobs no other resistance welders can do



THOMSON QUALITY is so important that we build our own transformers to assure maximum performance and reliability. For all **AUTOMATED** and **HIGH-PRODUCTION** requirements — either special or standard design — **THOMSON QUALITY** is within your budget. A **THOMSON** quote will prove it.

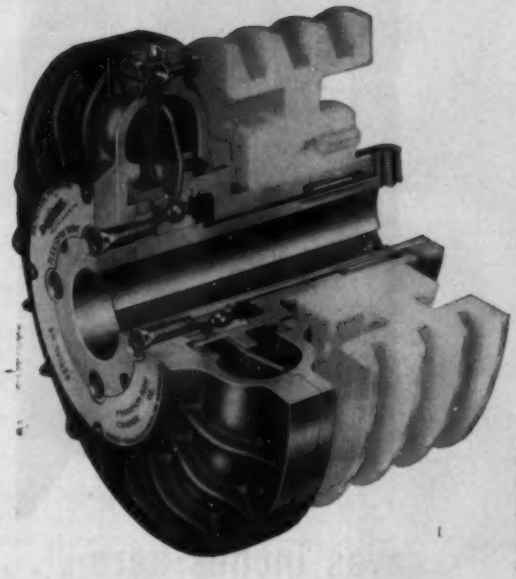
* patented

Look for our nearest representative in the yellow pages or contact —

Inventor of Resistance Welding
THOMSON ELECTRIC WELDER COMPANY
361 PLEASANT STREET, LYNN, MASSACHUSETTS

WHAT'S YOUR PROBLEM?...

- ☑ Overheated motors?
- ☑ Excessive belt maintenance?
- ☑ Breakage of materials being processed —like thread, wire, paper?
- ☑ Expense of oversize or high torque motors?
- ☑ High demand rate?
- ☑ Expense of reduced voltage starters?
- ☑ Clutch trouble?
- ☑ Breakage of transmission parts due to instantaneous shock loads?
- ☑ Damage and recurring down-time from overloads?



FLEXIDYNE

THE DRY FLUID DRIVE

It is no longer necessary to accept the destructiveness—the costliness—of conventional starting in the mechanical transmission of power. Flexidyne changes that!

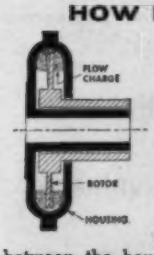
Flexidyne is the new way to start loads *smoothly*—to protect against shock and overload—to save power—all *without any sacrifice of efficiency at full load!*

This revolutionary development is ushering in "the day of the soft start"—which can mean thousands of dollars to you in equipment savings and in better, more economical operation.

Flexidyne is available, off the shelf, in Drives and Couplings. Capacities range from fractional to 1,000 hp. Ask your local Dodge Distributor or write us for technical bulletin.

DODGE MANUFACTURING CORPORATION, 100 Union St., Mishawaka, Ind.

HOW FLEXIDYNE WORKS



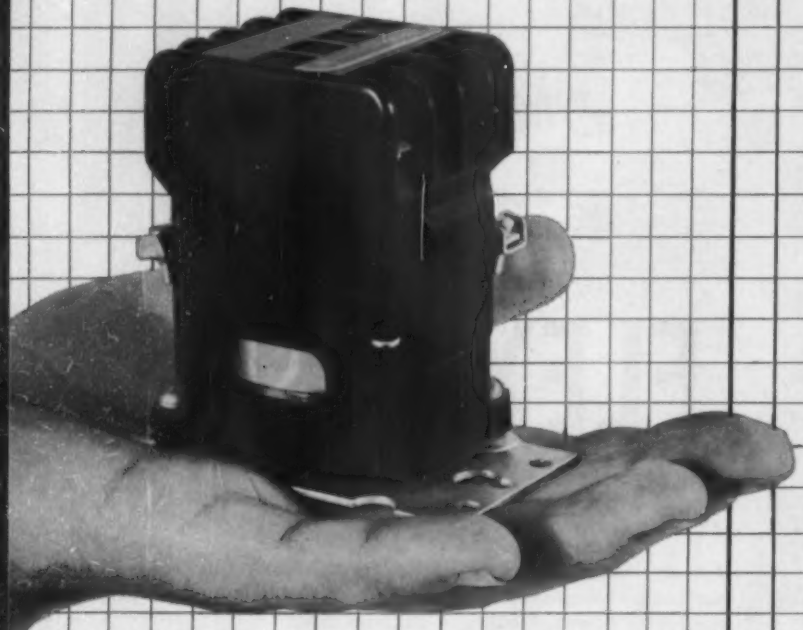
The "dry fluid" in Flexidyne is tiny heat-treated steel shot. A measured amount, called the "flow charge," is contained in the housing, which is keyed to the motor shaft. Inside the housing is a rotor, free to revolve relative to the housing, but connected to the load.

When the motor is started, centrifugal force throws the flow charge to the perimeter of the housing, packing it between the housing and the rotor, which transmits power to the load. Initial slippage is momentary. Housing and rotor become locked together and achieve full load speed without slip and at 100% efficiency.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery."

DODGE

of Mishawaka, Ind.



This new Westinghouse BF relay . . .

saves inches here . . .

This new Westinghouse BF relay is small and can be butted one against the other so that your control panels can be reduced in size as much as 50%. Result: valuable plant floor space available for additional machines. Because the relay is specifically designed for automated machine tools, you cut installed costs more than 20%. And since this relay is in stock, you get these savings NOW.

CIRCLE 277 READER SERVICE CARD

feet here . . .

Want more information on the 6-amp, 300-volt BF and its companion, the 10-amp, 600-volt AF? Contact your nearest Westinghouse representative . . . or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. J-30321-R

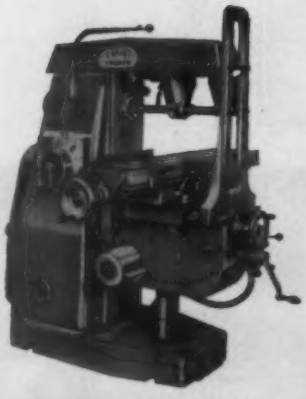
You can be sure...if it's **Westinghouse**

CIRCLE 278 READER SERVICE CARD

PAINSTAKING ATTENTION TO DETAIL
characterizes SAJO Millers

exemplified by the unsurpassed SAJO spindle construction employing double-row staggered roller bearings and ball thrust bearings — assures utmost stability and smooth transmission of full horsepower to cutter.

Available as
Plain, Universal & Vertical Millers.
Production Millers with automatic cycling.



No. 2 Universal Miller
table size: 52" x 11"
7½ and 1½ HP motors,
rapid power traverse.

austin industrial corporation

76-F Mamaroneck Avenue White Plains, New York

CIRCLE 279 READER SERVICE CARD

MSO
Since 1865

FOR MORE PROFITABLE GRINDING

For toolroom or job shop this MSO Universal Grinder with 7" x 12" capacity is unexcelled in sensitivity, accuracy, finish.

MODEL FMES
a true Universal Grinder
with compound swivel
wheelhead
fine in-feed to .00005"

Whether for toolroom or production, MSO offers a complete line of precision grinding machines with features such as:

Automatic cycling
+ Precimatic sizing
+ Electronic Match Grinding

WRITE FOR LITERATURE ASK FOR REFERENCES

When only the best will do, check MSO first

austin industrial corporation

76-F Mamaroneck Avenue White Plains, New York

CIRCLE 280 READER SERVICE CARD

Fractional Horsepower Drive Has Speed Ranges From 4660 to 1.2 rpm

Speed-Trol variable speed drive is reported to have the shortest overall dimensions and to be up to 15% lighter than competitive units. Speed ranges from 4660 to 1.2 rpm with up to 10 to 1 variation are offered in ¼, ½, and ¾ hp ratings. Larger pulley diameters assure cooler running.

Retention of important NEMA standard dimensions for shaft height and diameter permit substitution with standard motors. Electrical characteristics and enclosures include single phase, three phase; drip-proof, totally enclosed, and explosion-proof. The unit may be foot-mounted in any position or can be furnished with face mounting bracket. It is available with right angle and helical gears.

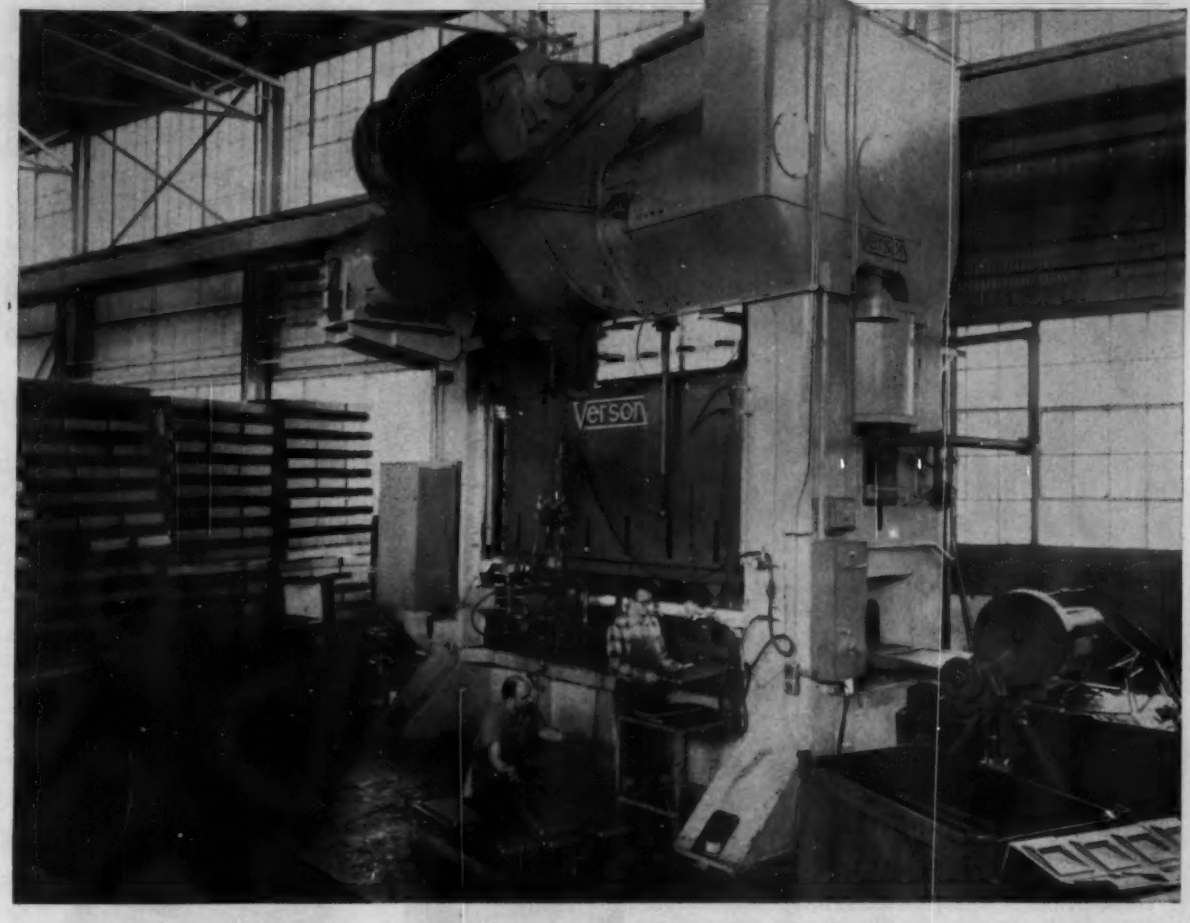
Sterling Electric Motors Inc, 5401 Telegraph Rd, Los Angeles 22, Calif

MORE DATA? Circle 101, inside back cover

SERIES OF SMALL, 4-figure electric counters—with speed, ruggedness, and dependability of larger counters—are priced at only $14. Designated the Model 4-Y-9434 Series, they are available for base, top, or panel mounting —*Durant Mfg Co, 1945 N Buffum St, Milwaukee 1, Wis*

MORE DATA? Circle 102, inside back cover

THE PROCESS IS MORE IMPORTANT THAN THE PRESS...



–Verson– engineered progressive die tool-up produces two sizes of electrical enclosures and covers for Federal Pacific Electric Company

The most important fact about any press is what it can be made to do. This Verson 1000 ton eccentric press produces *two* sizes of electrical enclosures and covers with the *same* tooling at 20 strokes per minute.

The press is installed in one of the Newark, N. J., plants of Federal Pacific Electric Company, a progressive, fast-growing manufacturer of products for the distribution and control of electricity.

Two sets of progressive die tooling are employed. One set can be adjusted without removal from the press to produce two sizes of panel enclosures (11¼" x 24" and 13½" x 24"). The other set can be adjusted to produce covers for both sizes of enclosures. Five operations are performed on the enclosures, seven on the covers.

When you are looking for ways to improve the efficiency of your production processes, discuss your stamping requirements with a Verson engineer. He'll show you the difference in specifying a process rather than just a press. Call or write, today, for prompt attention to your needs.

237

Originators and pioneers of allsteel stamping press construction

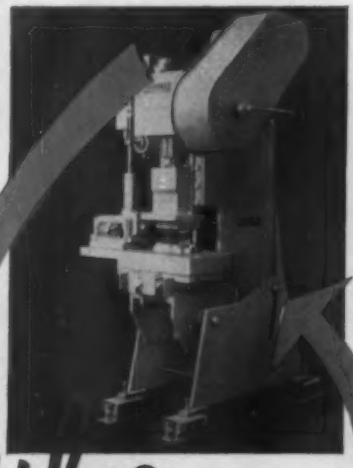
VERSON ALLSTEEL PRESS CO.

–Verson–

9316 S. Kenwood Avenue, Chicago 19, Illinois • 8300 S. Central Expressway, Dallas, Texas

MANUFACTURERS OF MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES

TRANSMAT PRESSES • IMPACT MACHINING PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES • HYDRAULIC SHEARS



NEW!

Circulube

by BIJUR

A system of centralized, completely automatic machine lubrication with provisions for oil return

2-gallon Lubricators, Model CLFB continuous delivery, Model CLFC continuous AND cyclic delivery.

½ gallon Lubricator, Model CLWB continuous delivery.

Pressure Signal Switch, Model C-2512.

This new system continuously circulates clean, filtered oil through machine bearings at controlled rates. It also provides for filtering and removing contaminates from returned oil before recirculation.

WHAT IT DOES

Oil is pumped to bearings through the system, and returned through tubing or piping as advised by Bijur's engineering staff. Control-Units, installed at each bearing, control the flow of oil to that bearing.

Model CLFC has a dual pump which also permits cyclic oil delivery to certain bearings.

HOW IT WORKS

Basically, the Circulube system consists of a lubricator pump with reservoir and filter, a distribution system, and the control units at each bearing. The "brain" of the system is the Pressure Signal Switch. It prevents machine operation until proper oil pressure has been developed.

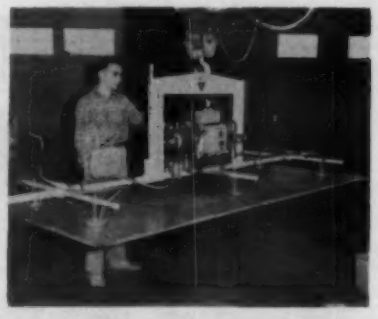
EXCEPTIONAL EFFICIENCY

Circulube offers three different new units, in two sizes, one supplying cyclical delivery of oil where required. It enables you to incorporate in machine design a foolproof lubrication system, prevents machine damage from inadequate lubrication, and provides maximum flexibility of application.

Write us for Bulletin CL, giving complete, detailed information.

BIJUR LUBRICATING CORPORATION
Rochelle Park, New Jersey
Pioneers in Automatic Lubrication

2741



90° Manual Vacuum Turnover Unit Handles 180-lb Steel Sheets

Lightweight 6-pad unit is self-contained with the Powerpac mounted for close tolerance on a pad beam 9 ft long with three 2-ft 6-in. adjustable cross arms to handle material up to 14 ft in length. The pad beam is on trunnion bearings with a lifting bail for 90° tilt. It is equipped with manual guide and tilt bar with pushbutton vacuum controls mounted within easy reach in the handle. The six special pads are one-piece cast aluminum with nonmarking Neoprene snap-on seal rings.

Vac-U-Lift Co, Salem, Ill

MORE DATA? Circle 103, inside back cover

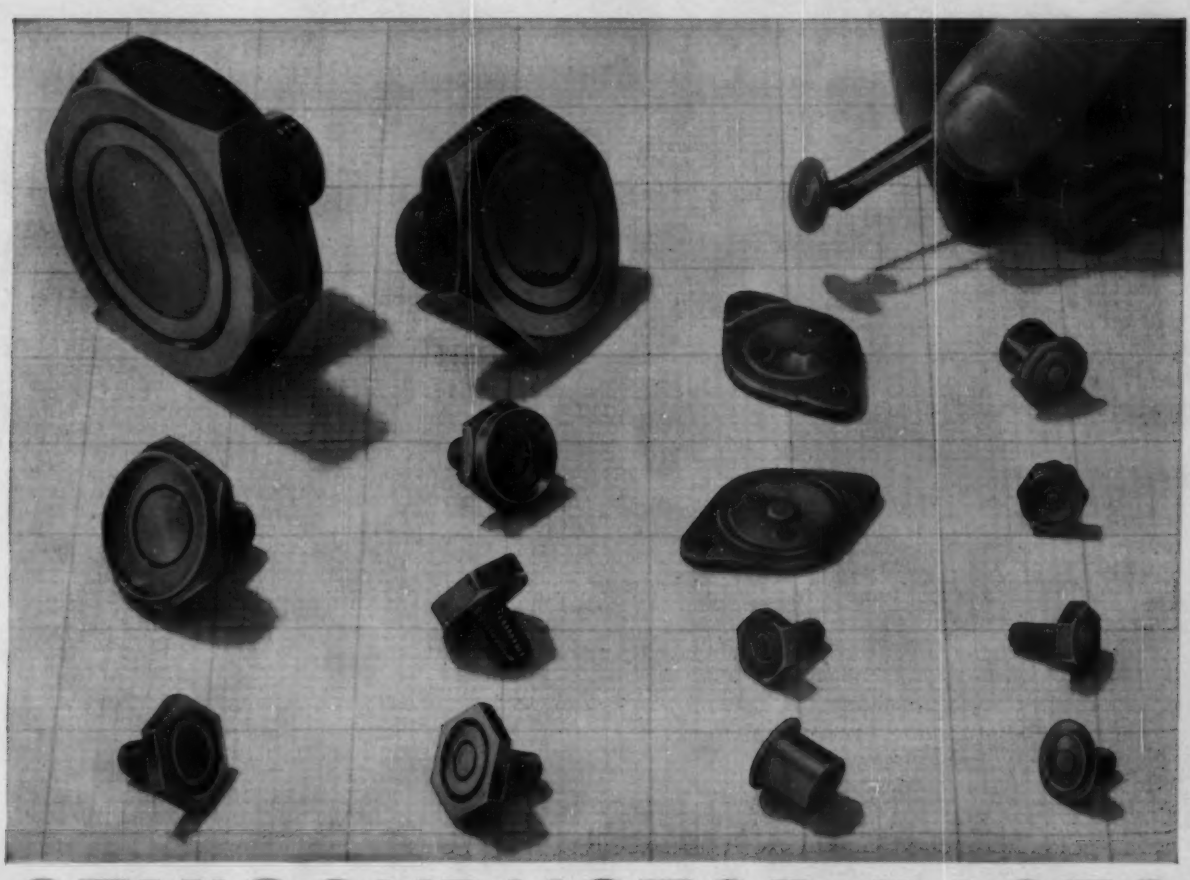
Optical Leveling Kit Permits Readings to 0.001 in.

Principal components of the kit are a tilting level, an optical micrometer, and specially designed K&E Wyteface scales. Kit, in a reinforced wooden case, weighs 23 lb. Four major applications are foundation and bedplate leveling; differential leveling; profiling (the measurement of irregular or curved surfaces); and checking the movement or settling of heavy equipment.

In addition to basic components, the kit includes a right-angle mirror, a scale level and a scale magnet. Complete line of optical accessory equipment is available.

Keuffel & Esser Co, Optics & Metrology Div, Third & Adams Sts, Hoboken, NJ

MORE DATA? Circle 104, inside back cover



SEMICONDUCTOR BASES

These Anaconda coppers help you achieve economical volume production of essential electronic components.

As the use of semiconductor devices soars, production methods must be geared to economical volume production, and the selection of metal for the bases becomes critical. Electrolytic Tough Pitch (ETP) Copper has the high electrical and thermal conductivity required, but the severe heat cycling encountered in degassing and brazing the devices during manufacture limits its use. The copper alloy must be deoxidized or oxygen-free to resist hydrogen embrittlement. For secondary operations, it must also have good machinability. And where high torque is used to tighten the base to the heat sink, it must in addition have relatively high strength.

COPPER METALS. Various combinations of the desired properties are found in these Anaconda alloys: DLP Copper-104 (deoxidized low phosphorous), OFHC* Copper-120 (oxygen-free high-conductivity), Tellurium Copper-127, Chromium Copper-999, and Amzirc* (Zirconium Copper)-134.

FABRICATING METHODS. Anaconda specialists can help you select the right alloy and form of metal—and the manufacturing method best suited to meet your design and fabrication problems. Depending on the size and design of the base, the production runs involved, parts may be produced in a variety of ways. Cold heading may be most economical for some, others might be die-pressed forgings, screw machine or punch-press parts. And for many of the smaller parts, multiple-plunger-press fabrication could offer the greatest economies. These specialists can also help you utilize such cost-cutting techniques as roll threading of studs, and advise you on welding and brazing procedures.

Whatever your problem, Anaconda offers specialized technical help—yours for the asking. See your Anaconda representative or write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 6973

*Trade-mark of American Metal Climax, Inc.

ANACONDA®

COPPER PRODUCTS FOR THE ELECTRICAL INDUSTRY

Anaconda American Brass Company

300% FASTER ULTRASONIC CLEANING*

with SELF-TUNING

Self-tuning Autosonic cleaners by Powertron clean faster, better and cheaper because they: Eliminate operator training and monitoring; Release labor for other work; Reduce rejects; Save on solvents.

HERE'S HOW IT'S DONE

The Autosonic is electronically self-tuned by its exclusive feedback transducer and requires no tuning knobs or meters. A simple switch is the only control.

Only Autosonic cleaners give you consistent peak performance cleaning regardless of load, solution level or temperature, contamination or operator inattention.

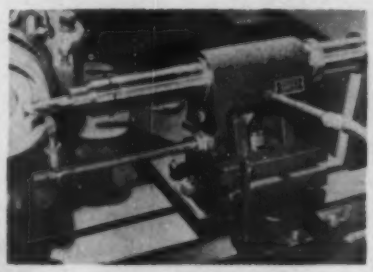
Powertron's complete line of Autosonic generators, tanks, cabinet models, degreasers and immersible transducers is immediately available from stock. Ask for free demonstration by Sales Engineer.

*Case Histories on File.

WRITE FOR FREE BULLETIN 60-1 "HOW TO CLEAN ULTRASONICALLY WITH SELF TUNING"

POWERTRON ULTRASONICS CORP.
DEPT. AM-11
PATTERSON PLACE • ROOSEVELT FIELD
GARDEN CITY, L.I., NEW YORK • PIONEER 1-3220

NEW SHOP EQUIPMENT



End-Mill Sharpening Fixture Features Air-Bearing Spindle

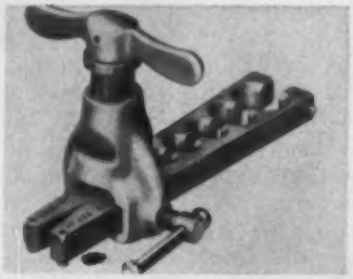
This end-mill sharpening fixture has its precision spindle supported by an air bearing. Because the air bearing minimizes friction, it permits a smooth, effortless grinding motion of the spindle and speeds up the tool-sharpening operation. The fixture mounts directly on the table of any make tool grinder.

The spindle accommodates straight-shank end mills from 3/16 to 1¼-in. dia with a matched bushing set. The company also supplies bushing adapters to fit shanks with B&S, Morse, Jarno, and camlock tapers. Air from shop supply at 60 to 90 psi floats the spindle.

The No. 7 combination end-mill sharpening fixture with air spindle consists of a sub-base, rocking head, finger-arm assembly, air-spindle assembly, and tools necessary for servicing, all in a fitted case. The No. 7 is priced at $300. A No. 7 AC conversion kit for existing Weldon end-mill sharpening fixture sells for $112.50.

The Weldon Tool Co, 3000 Woodhill Rd, Cleveland 4, Ohio

MORE DATA? Circle 105, inside back cover



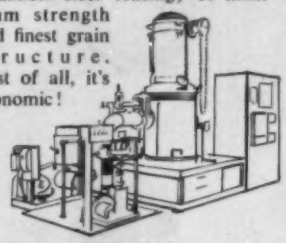
RIGID FLARING TOOLS produce uniform 45° or 37° flares quickly on copper, aluminum, and brass tubing. All working parts are locked together; bottom of yoke automatically gages flares for uniform length; flare wall thickness is controlled by automatic feed release; flare is burnished when feedscrew is released—*Ridge Tool Co, Elyria, Ohio*

MORE DATA? Circle 106, inside back cover

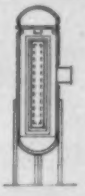
HERBERT W. WESTEREN, Assistant Director of Hayes Research and Development Group, tells about the . . .

"VACUUM AGE" OF HEAT TREATING

A major New York manufacturer of aircraft equipment recently reported their Hayes Vacu-Master Cold Wall Furnace was paying off in many ways — providing rapid cycling, simplified work handling, and complete production flexibility. Additionally, the vacuum furnace has eliminated need for atmosphere equipment . . . and produced work (stainless steel brazing) of maximum strength and finest grain structure. Best of all, it's economic!

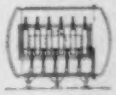


Similar Success Stories come to us from other users of Hayes Furnaces. Successful heat treating of "exotic" metals (tantalum, titanium, niobium, etc.) in the 2600 to 4500°F range. Successful sintering, hardening, annealing, and degassing at high production rates. Success stories all around!



The "Universal Atmosphere" has Universal Applications

Unlike other "atmospheres," vacuum has virtually no job limitations. Here's where the ingenuity of Hayes development engineers comes into play. By coordinating furnace design with job requirements . . . and by PROVING RESULTS in the Hayes lab . . . Hayes vacuum furnace engineers assure the customer a "RESULTS GUARANTEED" installation every time. I'd like to invite you to advance your heating into the "vacuum age" . . . with HAYES!



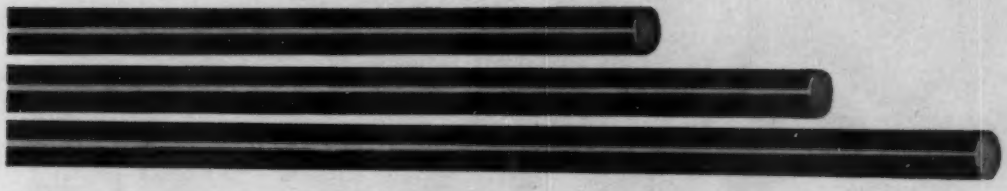
Write for vacuum Bulletin 5709A.

C. I. HAYES, INC.
Established 1921
837 WELLINGTON AVE. • CRANSTON 10, R. I.

It Pays To See Hayes for metallurgical guidance, lab. facilities, furnaces, atmos. generators, gas and liquid dryers.

*Important Cost-Reducing News from 30 Years of Research and Production of High-Strength, Furnace-Treated Steels!**

NOW IN ALLOY AS WELL AS IN CARBON



BLISS & LAUGHLIN MONEY-SAVING Strain-Tempered®

COLD FINISHED STEEL BARS

* Eliminate Heat-Treating Costs

* Save In Grade and Processing Extras

* Pay Only For the Grade Needed

Bliss & Laughlin again brings you another benefit of its long-range product development program—ALLOY Strain-Tempered bars to supplement an extensive line of CARBON Strain-Tempered bars. The cost-saving advantages are significant!

IF YOU USE HEAT-TREATED ALLOY BARS, you can save up to 30% in processing extras by switching to Bliss & Laughlin Strain-Tempered Alloy bars. Strength and hardness are equal. Machinability is comparable. Ductility is somewhat lower, but adequate for many applications. Size limitations depend on individual specifications. With Strain-Tempered Alloy bars, it is frequently possible to select a grade with a lower grade extra than is possible with heat-treated alloys, thus saving additional money.

IF YOU HEAT TREAT ALLOY STEEL PARTS, Strain-Tempered Alloy bars may meet your hardness specifications at lower cost. In addition, problems of distortion and finish associated with heat treatment are eliminated. Strain-Tempered Alloys can be tailored to hardness in the 30 Rockwell "C" range and up to 40 Rockwell "C" and higher in some combinations of size and alloy grade. Ductility and impact properties, while lower than in heat-treated alloys, do not impair performance in many applications.

IF YOU HEAT TREAT CARBON STEEL PARTS, Bliss & Laughlin Strain-Tempered Carbon steel bars will provide equivalent strength and hardness, with adequate ductility and toughness. You save heat-treating costs, reduce fabricating time and eliminate costly operations formerly required to correct distortion of parts in heat treatment.

IF YOU NOW BUY C-1144 STRAIN-TEMPERED OR COMPARABLE TRADE NAME STEELS, a review of your machining operations may indicate costs can be reduced by switching to a lower-cost, less-machinable grade. We'll gladly send a chart showing comparative data. By selecting the grade providing only the machinability needed, you do not pay a premium for machinability you do not use. Savings can range up to $24.00 per ton.

RESEARCHED AND PRODUCED FOR 30 YEARS. High-strength, furnace-treated steel bars were pioneered by Bliss & Laughlin 30 years ago. They are backed by nearly 70 years of experience in producing all grades of cold finished steel bars that can be used profitably by customers. In 1929, the first Strain-Tempered bar was produced for automobile drive shafts. By 1931, Bliss & Laughlin supplied 75% of one automotive company's requirements. Today Bliss & Laughlin is furnishing large quantities of standard alloy grade Strain-Tempered bars for drive shafts, as well as for many other purposes requiring high strength. A notorized certified report on the chemical and physical properties accompanies every Strain-Tempered mill shipment, evidence of the exacting quality standards which you can expect from Bliss & Laughlin.

You will be money ahead asking a Bliss & Laughlin representative to analyze your present use of high-strength alloy and carbon steels. He will recommend without obligation, the most suitable, least costly alloy or carbon grade from Bliss & Laughlin's extensive line of Strain-Tempered bars.

Specialists in Finish, Accuracy, Straightness, Strength and Machinability

BLISS & LAUGHLIN

GENERAL OFFICES: Harvey, Ill. • MILLS: Harvey, Detroit, Buffalo, Los Angeles, Seattle, Mansfield, Mass.

Leading Independent Producer of Cold Finished Steel Bars

NEW

ERICKSON

MASTER SPACER

with No. 0 Timken Bearings

gives increased production and optimum accuracy in

straddle milling

milling

jig drilling
with either micrometer or "Jo" block setting

inspection

Write for free catalog "Erickson Master Spacer" today. And at the same time request your copy of Catalog K; you'll find cost-slashing applications for all Erickson holding tools.

The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This *one* tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. *Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle.* Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

The new Erickson Master Spacer can help you come to grips with your Number One Problem—high production costs. The first step is to get the Erickson story.

AA-5093

ERICKSON TOOL COMPANY

34559-11 Solon Road • Solon, Ohio

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

USERS PROVE:

ALCO HI-QUA-LED STEEL FORGINGS CUT MACHINING COSTS UP TO 50%

ALCO

how three leading companies save money with ALCO Hi-Qua-Led steel forgings

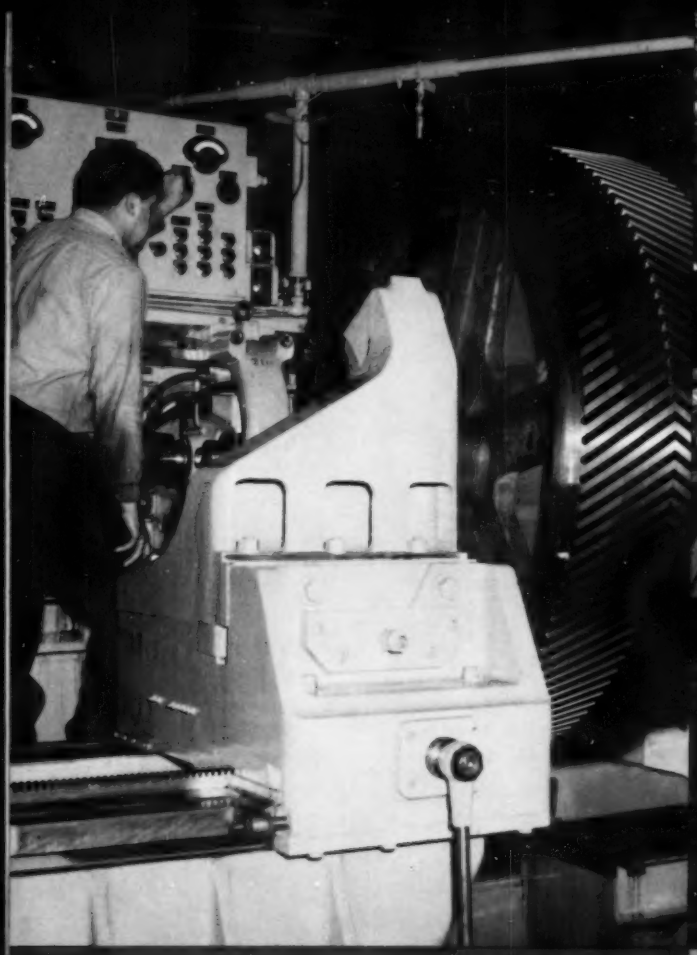
case report:

HI-QUA-LED FORGINGS CUT MACHINE TIME 45%

THE TOOL STEEL GEAR & PINION CO., Cincinnati, achieves large savings in gear-machining operations with ALCO's Hi-Qua-Led Steel forged and rolled rings. On one gear ring, for example, Tool Steel reduced turning time 22% before hardening, and 42% after hardening. Gear hobbing time was cut 43%, rebore 45% and key seating 50%. Average time reduction was 45%.

Hi-Qua-Led forgings machine this easily because of a lead additive which increases shear angle and reduces tool friction. Result: heavier cuts and higher cutting speeds. Expensive tooling lasts longer—five, 10, even 100 times longer.

These big savings are only part of the story. Because Hi-Qua-Led forgings have the same mechanical properties as regular forgings of the same grade, Tool Steel can stand squarely behind its unique guarantee: "Any deficiency made good by cash or new materials."



case report:

HIGHER QUALITY GEARS FOR THE SAME COST

LUFKIN FOUNDRY & MACHINE CO., Lufkin, Tex., uses Hi-Qua-Led forged and rolled rings for 60 in. diam. herringbone gears in its large oil-well pumping units. Previously, cast rings had been used.

Lufkin F&M finds that, although the Hi-Qua-Led rings' price is higher, their machinability cuts the cost of the finished fabricated gear to that of the cast gear. Lufkin is thus able to put a better, more uniform gear in its pumping units for the same cost and provide improved equipment and higher value to its customers.

The table below shows how Hi-Qua-Led rings reduced machining costs at Lufkin F&M.

HI-QUA-LED RING vs CAST RING

OPERATION	CASTING	HI-QUA-LED	HI-QUA-LED SAVINGS
Turning	20 hours	8.1 hours	59.5%
Shape Teeth	80 hours	60 hours	25%
Tool Expense	$75.00	$25.00	67%

case report:

INCREASED CAPACITY WITH NO ADDITIONAL INVESTMENT

WARNER & SWASEY CO., Cleveland, uses Hi-Qua-Led open-die forged bars for the pentagon-shaped tool holders in their 2AC and 3AC automatic chucking machines. It adopted Hi-Qua-Led for this job three years ago, because it found that machining speeds on every operation—turning, milling, sawing, trepanning, grinding and drilling—could be increased by at least 50%.

The decrease in machining *time* Warner & Swasey gets is about 3 hours per forging. This compensates for the extra cost of Hi-Qua-Led. But Warner & Swasey reasons that Hi-Qua-Led actually expands its production capacity, without any added investment in factory or tools. This is worth about $60 per forging, according to Warner & Swasey figures.

ALCO

ALCO HI-QUA-LED STEEL FORGINGS RAISE PROFIT WITHOUT LOWERING QUALITY

While lowering machining costs, ALCO Hi-Qua-Led forgings have the same mechanical properties as regular forgings of the same grade. "In use" tests show that tensile strength, impact, fatigue and other properties are unchanged. Further, ALCO's exclusive patented lead-addition process guards against lead inclusions or segregates. You get the high quality you expect in custom-forged material.

Hi-Qua-Led Steel rings and forgings are furnished in any steel analysis. If you wish, ALCO will make up your order of regular forgings and include in it a Hi-Qua-Led forging, at no extra cost, for ALCO-supervised tests in your own plant. ALCO Products, Inc., Dept. 1501, Schenectady 5, N. Y.

SIZES AVAILABLE

OPEN DIE FORGINGS—RECTANGULAR
Maximum width—32 in.
Maximum height—32 in.
Maximum length—40 ft
Maximum weight—36,000 lb
Minimum weight—1,000 lb

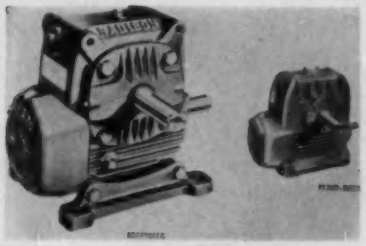
MANDRELLED RING FORGINGS
Maximum OD—82 in.
Minimum OD—24 in.
Maximum width—60 in.

OPEN-DIE FORGINGS—ROUNDS
Maximum OD—36 in.
Maximum length—40 ft.
Maximum weight—36,000 lb
Minimum weight—1,000 lb

ROLLED RING FORGINGS
Maximum OD—160 in.
Minimum OD—18 in.
Maximum width—24 in.

ALCO FORGINGS

ALCO PRODUCTS, INC.



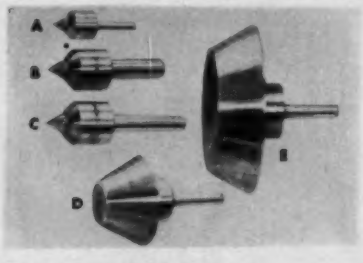
Fan-Cooled Worm Gear Reducer Line Introduced by Foote Bros

Radicon reducers are said to combine unlimited flexibility of mounting with high efficiency radiation and convection cooling to provide users with right angle power transmission that meets practically any requirement in the range up to 68 hp.

Made in 12 sizes with center distances from 1⅛ to 8 in., input capacities are from 0.01 to 68 hp, and output torque up to 46,000 lb-in. Speed ratios are available from 5:1 to 70:1. Involute helicoid worm thread design permits precision inspection and calibration during manufacture; gear tooth design insures positive lubrication regardless of drive direction or operating speeds.

Foote Bros Gear & Machine Corp, 4545 S Western Blvd, Chicago 9, Ill

MORE DATA? Circle 107, inside back cover



Heavy-Duty Live Centers Take Replaceable Points

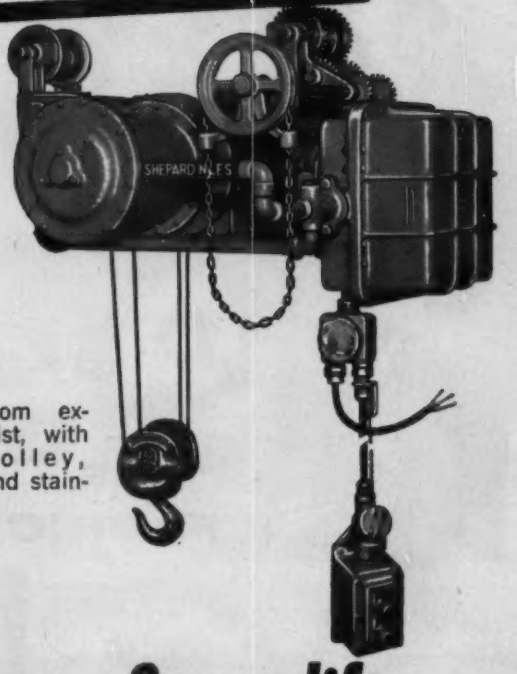
Points can vary from a precision male point to a bull nose model 3 to 8 in. in diameter. Specials have been made up to 10 in. in diameter for heavy weight tubing up to 9¾ in. ID. Construction of the centers features heavy-duty precision tapered roller bearings.

This improved line is available in range of sizes and radial load capacities from 1000 to 10,000 lb based on 100-rpm thrust. Each is available in Morse, Hendy, B&S, and straight shanks and also in special shanks for Jarno, Norton, Landis, and Cincinnati machine tools. Lubrication is needed only once a year.

Trio Machine & Mfg Co, Willoughby, Ohio

MORE DATA? Circle 108, inside back cover

JOB-MATED



Close head room explosion-proof hoist, with hand geared trolley, bronze wheels and stainless steel tackle.

Give profits a lift...

with Shepard Niles JOB-MATED Hoists

It's the exact combination of capacity, clearance, speed and controls that makes this Shepard Niles Explosion Proof Hoist exactly right for your particular job. A hoist accurately matched to the job cuts handling costs, moves more materials faster, and gives longer service life.

And it's easy to match precise job conditions at Shepard Niles. With thousands of types and sizes of hoists to choose from, you are sure to find the **right** hoist for truly efficient, economical performance in your plant.

You have your choice of ¼-ton to 20-ton capacities; of floor or cab controls; motor-driven or hand-operated trolleys; regular or long lifts; and regular or close clearances. Whatever combination you choose, you get the quality construction and advanced engineering that have made Shepard Niles America's largest manufacturer of hoists and cranes.

For complete details on Shepard Niles **"Job-Mated"** hoists, write for a descriptive bulletin, or ask a Shepard Niles representative to call.

SHEPARD NILES
CRANE AND HOIST CORPORATION

3108 Schuyler Ave., Montour Falls, N.Y., U.S.A.

NEW... IMPROVED... model 15A

the STRIPPIT
FABRICATOR

for high-profit, low-cost punching, notching and nibbling...for prototype, short and medium production runs

FEATURING the new *Strippit Electro-Hydramatic Head* — simplified design . . . minimum number of parts . . . needs no pressurized air. Makes the 15A easier to install, simpler to maintain, more economical to operate.

punches
any round or shaped hole up to 3½" diameter in sheet material — up to ¼" mild steel.

notches
90° corners — rectangular, radii, vee and special shape edge notches — up to ⅛" capacity in mild steel.

nibbles
straight line or contour shearing up to 38" diameter circle, at 165 strokes per minute, ⅛" mild steel.

accurate, quick-set gauging
a unique, multiple-stop system for exact work positioning to any layout specifications — *in seconds.*

quick-change punches and dies
from one size to another in less than 20 seconds — within easy reach in labeled, built-in file drawers.

easy conversion
to a high speed production punching unit with the Strippit Duplicator and the Dupl-O-Scope or Microbars to punch Duplicator templates.

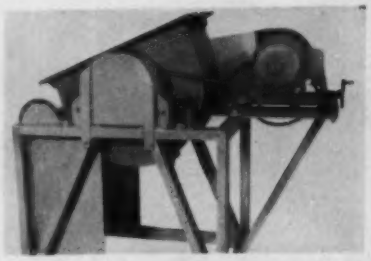
WRITE TODAY
for new Catalog 15A and demonstration at your own plant of the capabilities of this high-profit fabrication system.

A UNIT OF HOUDAILLE INDUSTRIES, INC.

WALES **STRIPPIT** INC.

200 Buell Road • Akron, New York

In Canada: Strippit Tool & Machine Company, Brampton, Ontario



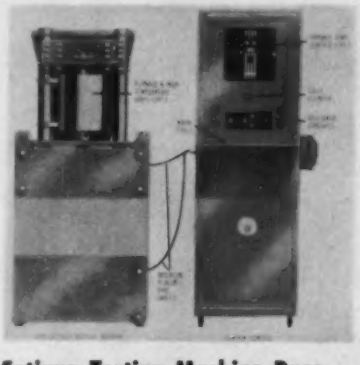
Vibratory Parts Finishing Machine Offered in 12-cu-ft Model

Ferra-Burr, in field tests, is reported to have produced superior deburring results on small motor housings where expensive hand finishing was formerly required. Machine has also finished small electronic parts and zinc die castings in 10% of the time previously required.

Basic design of the tub itself, and the positioning of the shaft housing, are said to contribute largely to the high production capacity. Finishing medium surrounds the parts at all times and the flow pattern induces pressure on the parts that is claimed to produce a superior luster without deformation.

Ultramatic Equipment Co, 1948 N Cicero Ave, Chicago 39, Ill

MORE DATA? Circle 109, inside back cover

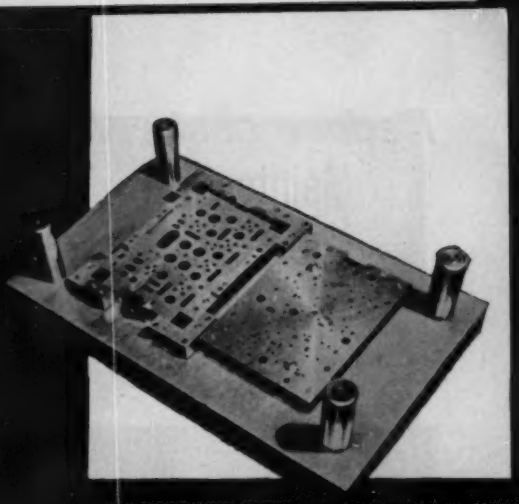


Fatigue Testing Machine Does Both Static or Dynamic Testing

The LAZ-1 universal testing machine provides for static or dynamic testing on a selective basis. Creep or fatigue work may be accomplished with either of the machine's two sections: the static unit (LAZ-1S), the dynamic unit (LAZ-1D), or both. Also, the static and dynamic units may be readily removed from the LAZ-1 and assembled in combination for direct use on structures too large or complex to be tested in the machine itself.

The Budd Co, 2450 Hunting Park Ave, Philadelphia 32, Pa

MORE DATA? Circle 110, inside back cover



Pat. No. 2355224

only vega offers you all these advantages

order after order after order... minimum size change and distortion... low temperature heat treating... uniform deep hardenability... freedom from scaling... good machinability... exceptional toughness with good hardness... no preheating in hardening. From start to finish you enjoy exceptional simplicity and safety and predictable performance. Produced by the MEL-TROL® Process... Only Carpenter VEGA-FM assures such uniformity of benefits. Use this MATCHED SET of Air-Hardening Tool and Die Steels—VEGA-FM (Type A-6), No. 484-FM (Type A-2), and No. 610-FM (Type D-2)—for proper selection and consistently better results. Call your Carpenter SERVICE-CENTER for prompt delivery.

Carpenter steel

you can do it ***consistently*** better with Carpenter Tool and Die Steels

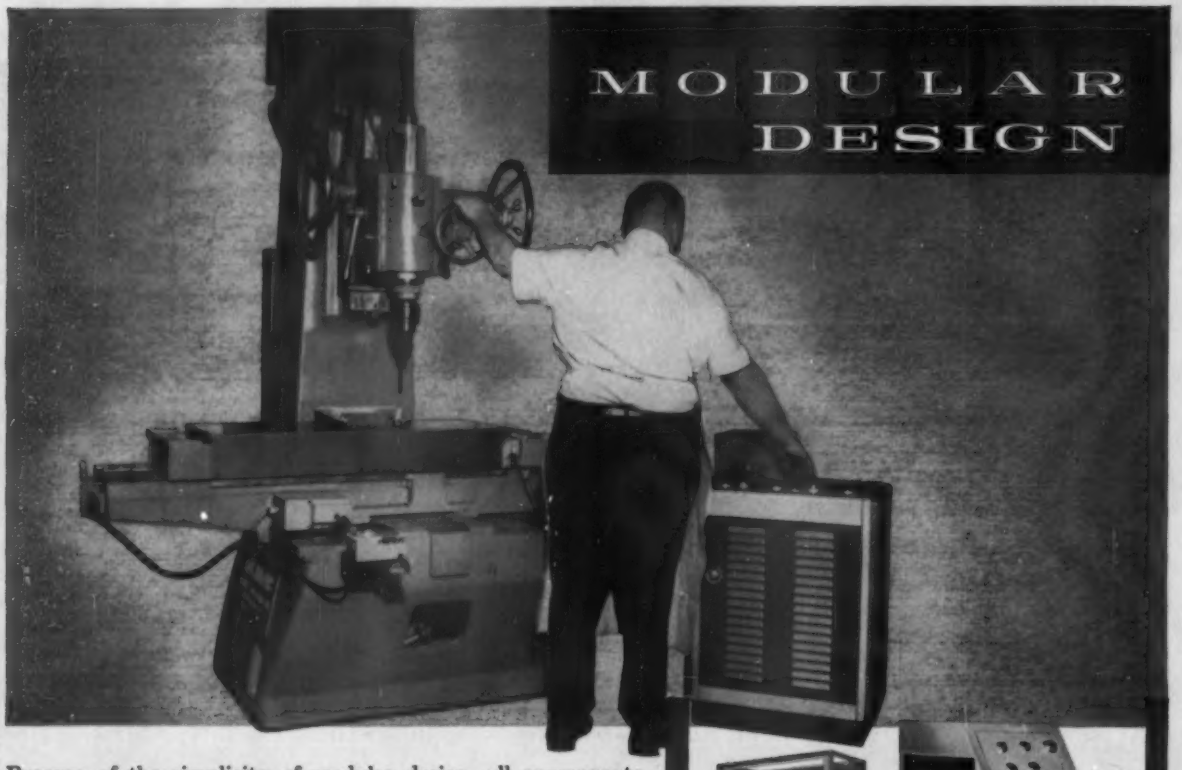
The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Webb Wire Division, New Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

Reduce costs of...

Maintenance
Labor
Downtime
WITH

SINGER*

NUMERICAL CONTROL

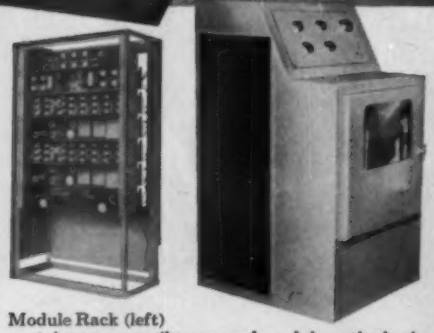


Because of the simplicity of modular design, all components within the Singer Numerical Control can be quickly and easily removed, replaced or modified.

Modular design is not the only outstanding feature of Singer Numerical Control. The high degree of accuracy is made possible by a division of the measuring section and the motor drive within the system. Accuracy of ± .001 inches on a work table with as much as 40 inches motion is another . . . increased accuracies up to ± .0002 inches are available with further refinement of the system, where compatible with the machine tool.

Singer Numerical Control Modular Design represents the most straight-forward approach to point-to-point positioning yet conceived. It offers the simplicity, reliability and economy necessary for the efficient operation of machinery.

You are invited to visit the demonstration room at Diehl Manufacturing Company's Finderne, New Jersey plant to see the Singer Numerical Control in operation and to examine actual production records. Write for the Singer Numerical Control Brochure.



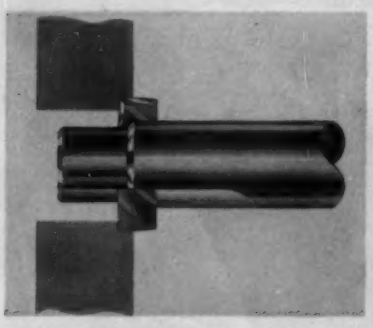
Module Rack (left) contains seven easily-removed modules—the basic components of the Singer Numerical Control System—and is housed within the main Control Console. Separate modules are easily accessible and the entire Module Rack may be rolled out from the Console on the self-contained tracks. Two types of Console Cabinet are available: the smaller NEMA 1 Cabinet (at operator's hand above) and NEMA 12 Cabinet (to right of Module Rack).

†A Trademark of THE DIEHL MANUFACTURING COMPANY
*A Trademark of THE SINGER MANUFACTURING COMPANY

Diehl†

DIEHL MANUFACTURING COMPANY
SUBSIDIARY OF THE SINGER MANUFACTURING COMPANY
Somerville, New Jersey

2361



Adjustable Cutter Line Offered For Counterboring, Spot Facing

Super-Centric tools reportedly will provide perfectly true counterbores with complete control of size, finish, and concentricity in virtually any material. They feature special grinds to eliminate deflection caused by difficult angles or imperfect diameters of the original holes in counterboring and to assure complete accuracy in spot facing operations. Tools are fully adjustable for a wide range of diameters.

Equally adaptable for back operations, they can be used singly or in multiple subland combinations. Tools are available in a large full range of sizes in HSS or with carbide tips.

Muskegon Tool Industries Inc, 11th at Western, Muskegon, Mich

MORE DATA? Circle 111, Inside back cover

Pressurized Metal Dust Hoods Designed for Delicate Assemblies

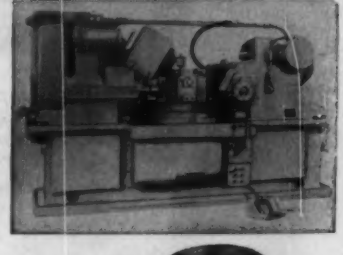
Line of hoods, known as the Metal Microvoid, is equipped with safety glass view windows and built-in fluorescent lighting. A quiet blower at the top forces room air into the hood through a special, large-area filter which removes dust particles down to 0.5 micron in diameter and provides an internal positive pressure which prevents unfiltered room air from entering.

Although these hoods are often supplied with open front panels for

ALL ENDS OF PARTS
Completely Finished
"1·2·3"
ON THE
GOSS *and* DeLEEUW
Automatic Chucking Machine
in 1 SET-UP

This recent Goss & DeLeeuw development has already received universal acclaim as an outstanding achievement.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages which result in vastly greater production at a fraction of parts' costs by other methods.



Easy, fast change-over from job to job makes this machine ideal for short-run requirements. Sturdy construction, power and speed make its advantages also apparent on long runs.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence — a method exclusive with Goss & DeLeeuw and offered on this machine.

Illustrated literature available promptly on request. Send samples of your work for time and cost estimates.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

GOSS *and* DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Convert BROKEN Drills from WASTE to PROFITS!

CAL CHUCK®

Exclusive NEW

POSITIVE DRIVE CHUCK for BROKEN, Shankless and All Flute Drills

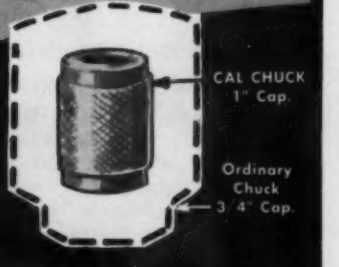
A brand new, tested and proven chuck with an exclusive, patented driver plate especially designed to eliminate costly drill waste. Instead of tossing the broken drill on a scrap heap, the machine operator simply grinds off the shattered end, puts a Cal Chuck on the Drill Press or Lathe, inserts the drill and keeps on working with a minimum loss of time and effort.

Cal Chucks are available in 3 sizes, covering 3/32" to 1" drill capacity. They are much smaller and lighter in weight, yet will outdrive comparable chucks without slipping.

SUPERIOR FEATURES!

- *Self-Energizing Collet automatically tightens as the pressure on the drill increases.*
- *Keyless! No keys to bother with or misplace. Just a slight twist of the knurled barrel is sufficient to securely grip or release the drill.*
- *No Factory Servicing Required. Easily and quickly taken apart by any operator.*
- *Accommodates all Flute Drills, as well as BROKEN drills.*
- *All steel construction.*

DRIVE 1" DRILL with 2" DIA. CHUCK



Note the appreciable size difference between a 1" capacity CAL CHUCK (patented) and a regular, popular make 3/4" capacity chuck.

MAIL COUPON FOR COMPLETE FACTS

Tested and Proven For
DRILL PRESSES
PORTABLE DRILLS
LATHES
SCREW MACHINES

CAL CHUCK CO.
5016 W. Burleigh St.
Milwaukee 10, Wis.

☐ Send me more information and literature.

☐ Have the Cal Chuck sales representative in my territory call on me.

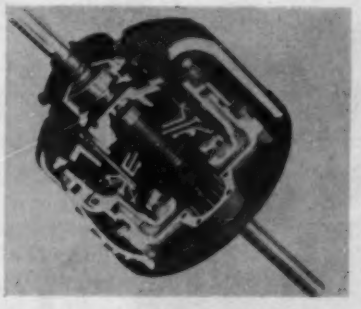
NAME _____
TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE ____ STATE _____

CAL CHUCK COMPANY, INC.
5016 W. BURLEIGH ST.
MILWAUKEE 10, WISCONSIN

easy access, special arm port panels are also available. In addition to providing optimum dust controls, these serve as protective covers when hoods are not in use. A variety of cabinet shapes and sizes are available in both aluminum and unpainted stainless.

Air-Shields Inc, Hatboro, Pa

MORE DATA? Circle 112 inside back cover



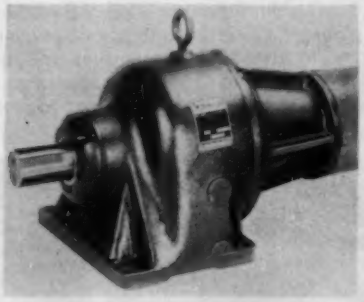
Drive Is Infinitely Variable In Torque and Speed

VariDraulic drive is a controllable hydrostatic fluid coupling. While the power source is operating at a constant speed the VariDraulic enables the power to be applied smoothly to the load and varied to suit the load requirements as to speed or torque.

Self-contained unit is positively and infinitely variable in torque and speed. It provides a flexible, shock-free speed control between power source and work load. The drive is available in a wide range of sizes, standard packages, or with special shafts, housings, and controls to suit specific requirements.

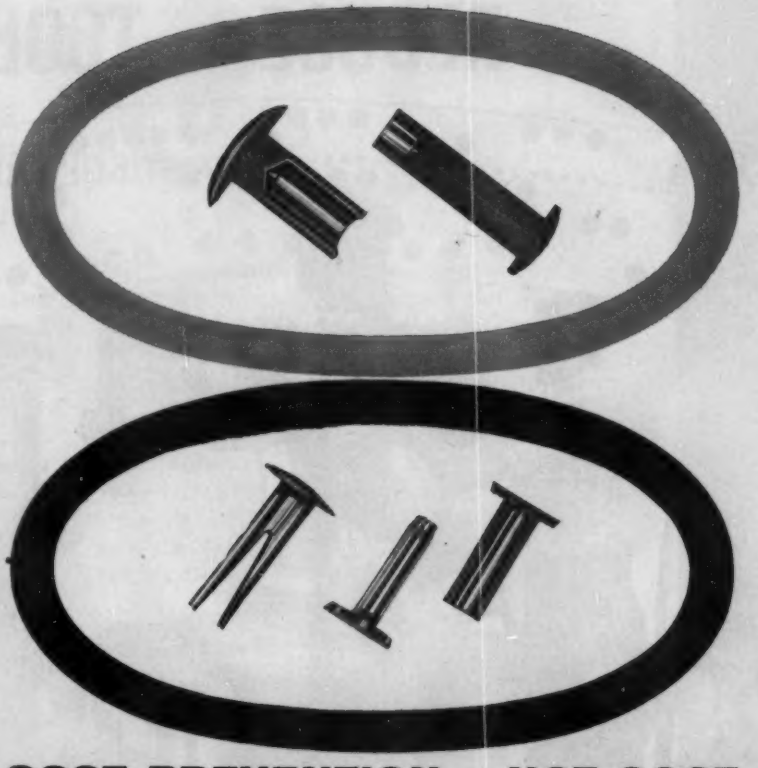
Hydraulics Inc, 1720 South Blvd, Parsons, Kans

MORE DATA? Circle 113, inside back cover



HM SERIES OF SEVEN horizontal differential speed reducers have ratios from 1.1:1—50,000:1, a hp range of 0.12—81.51, and a maximum output torque range of from 50—113,000 in.-lb. The series has a unified helical gear planetary element, said to be an exclusive — *Winsmith, Inc, 115 Eaton St, Springville, Erie County, NY*

MORE DATA? Circle 114, inside back cover



COST PREVENTION...NOT COST REDUCTION...IS THE EFFICIENT WAY TO LOW-COST ASSEMBLY

The "in-place" cost of a fastener is what really counts to cost-conscious production men. By deciding on inexpensive Milford tubular rivets as a fastening method and installing them with Milford automatic rivet-setting machines, design and production engineers are eliminating costs at the initial production stage rather than trying to reduce costs later at the assembly line.

You can find out more about Milford's cost-cutting ideas by asking your Milford Representative to show you Milford's new MANUAL OF MODERN RIVETING PRACTICE. It's crammed with valuable cost-cutting tips and technical data that can be quickly translated into dollars on your production line.

THE MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • NORWALK, CALIFORNIA
ELYRIA, OHIO • AURORA, ILLINOIS • HATBORO, PA

REDUCE TOOL COSTS $3000

save 5 weeks lead time

Burgmaster Model 2BHT 6-Spindle Turret Drilling, Tapping and Boring Machine equipped with Hughes 2-Axis Numerical Controls. X-Y axis controls table motion and machining of holes in flat plane. In this setup, a third motion controls the rotary fixture to automatically machine all radial holes. This is accomplished by a switching device on the Control Panel converting "Y" information to rotary information.

Rocket Bulk Head is completely drilled, countersunk and tapped on Burgmaster Tape Controlled Turret Drill without jigs or drill bushings. 16 tools are used to machine 69 holes.

Table Servo-Motors position table at 180 in./min. within ±.0005", repeatable to ±.0002", non-cumulative. Each axis of table motion is equipped with heavily pre-loaded ball bearing lead screws and anti-backlash ball nuts. Automatic clamps lock table into a rigid unit during machining.

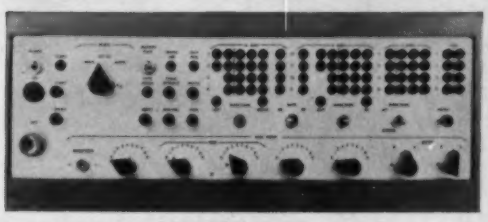
ON ROCKET PART

at Hughes Aircraft Company

Hughes Aircraft, Tucson, Arizona, use a Burgmaster 6-Spindle Turret Drilling, Tapping and Boring Machine equipped with 2-axis Tape Controls for controlling X, Y, and rotary motions to materially streamline production of small lots. Typical savings are shown in drilling, countersinking and tapping 69 holes in a lot of 50 cast iron Rocket Bulk Heads. Due to the fully automatic action of the tape controlled Burgmaster Turret Drill, expensive jigs and fixtures are eliminated — reducing tool costs $3000 — while saving 5 weeks lead time getting the job into production.

This is maximum flexible automation. Fully automatic machining is carried out in accordance with the commands of an easy-to-prepare tape performing any combination of six operations without tool changing. Individual preselective spindle speeds and feeds assure each operation is done at optimum tool efficiency for fine finish, precision, speed and long tool life. Engineering changes involving revision of machining can be done quickly by simple tape modification.

BURGMASTER



Hughes 2-Axis Tape Control Panel mounted at eye level on the Control Cabinet is provided with display lights that show accuracy of programming at a glance. This 2-axis system automatically controls positioning of the Burgmaster machine table on the X-Y axis simultaneously and directs the "third" axis when needed. A third axis of control may be added to the system to govern individual spindle depths, thus eliminating manual setting of the standard machine depth stops; or control special indexing fixtures with ±0° 03′ for automatic location and machining of radial holes, etc. Operator can dial dimensional commands directly into panel for any axis.

Job Facts

Company: Hughes Aircraft Company, Tucson, Arizona

Machine: Burgmaster Model 2BHT-L 6-Spindle Turret Drilling, Tapping and Moring Machine equipped with Hughes 2-Axis Numerical Controls.

Part: Cast Iron Rocket Bulk Head.

Quantity: 50 parts.

Holding: Flat Plane Holes — Simple Adapter Plate; Radial Holes — Special Vertical Rotary Fixture controlled by "Z" axis.

Accuracy: Flat Plane Holes — ±.0005" hole centers; Radial Holes— ±0° 03′

Savings: $3000 tool costs; 5 weeks lead time.

Other Advantages: Fewer rejects due to elimination of human factor; less inspection; reduced floor space required; much faster engineering changes; economical production of small lots; less tool changing; less work movement.

ALL LEADING STANDARD MAKES of Numerical Controls are available in Burgmaster Tape Controlled Turret Drills at Customer's preference. Write for literature describing 6 and 8 spindle machines with complete specifications and features. Twenty minute 16mm sound film showing Burgmaster turret drills in operations, including, the new automatic positioning table, available from any office.

World's Largest Builder of Turret Drilling Machines

"D" Manual Power Index ¼" Capacity

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ⅜" Capacity

2BH Ram Type Radial Drill ⅜" Capacity

2BH Automatic Hydraulic ⅜" Capacity

2BH Automatic Hydraulic 1½" Capacity

2SAH Automatic Tape Controlled 1¼" Capacity

2BHT-3BHT Automatic Tape Controlled ⅜" and 1½" Capacity

BURG TOOL MANUFACTURING COMPANY, INC.

15001 South Figueroa St., Gardena, Calif.

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BURGMASTER DIRECT SALES OFFICES: Ridgewood, N.J., 86 North Maple Ave., Gilbert 4-3002 • Chicago 5, Ill., 4908 Lincoln Ave., LOng Beach 1-1178 • Cleveland 7, Ohio, 14706 Detroit Ave., ACademy 6-3700 • Detroit 37, Mich., 13730 W. Eight Mile Rd., Lincoln 8-4333 • Northern California, JEfferson 7-1650

Plus dealer representatives in other industrial centers.

CIRCLE 297 READER SERVICE CARD

Another case history on TORIT Dust Collectors

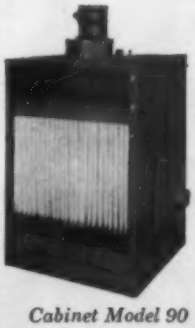
"THE GRIEVANCE COMMITTEE IS HERE ...ABOUT THAT DUST AGAIN!"

"This was the third time in a month that the grievance committee had complained about the dust in the shop. And this time they wanted to know what I intended to do about it.

"Frankly, I was on the spot. Oh, not that I blamed the workers. I knew the shop was dirty. How could it be anything else with grinding machines running 16 hours a day? And I was as unhappy about the situation as the employees were. Poor employee morale was serious enough—and absenteeism, machine wear, misalignment and down time caused by dust was costing plenty.

"Then I remembered a salesman with a dust collecting machine system had called on me a few months back. I dug his card out of the file and found he was from the Torit Company. I got him in pronto—and I bought one of his Model 90 Cabinet machines for less than $1,000. It services four surface grinders and it really performs. A month later I had Torit Dust Collectors installed for the rest of the machines.

"Torit Dust Collectors have practically eliminated the dust in our shop. And you can imagine the effect this has had on employee morale. People are happier and healthier. Absenteeism is no longer a problem and our production rate is higher than ever."



Cabinet Model 90

Torit can solve your dust problems. For complete facts on dust . . . and how to control it . . . write

TORIT manufacturing company

1133 Rankin St., St. Paul 16, Minn., Dept. 431

Portable Gantry Adjusts Height, Spread, and Level

Mag ic-Pole has telescoping legs with up to 6 ft of height adjustment, and a self-aligining I-beam that can be safely loaded from off center. Trolley is free to travel the full length. Unit can be set low for moving under overhead obstacles, and narrowed to under 4 ft for rolling through tight spaces. It can be quickly raised to the exact height required at the job. Both ends may be adjusted separately for resting on platforms, truck beds, or in pits.

Gantries are available with steel or aluminum alloy I-beams in spans up to 20 ft, heights to 17 ft, and capacity to 4 tons.

B E Wallace Products Corp, Exton 1D, Pa

MORE DATA? Circle 115, inside back cover

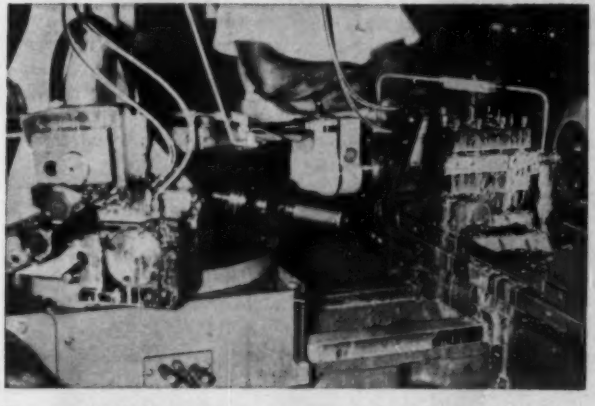
Live Roller (APC) Conveyor Supplements Wheel-Type Line

Model 1250, a new live roller adjustable pressure conveyor, handles larger, wider, heavier, and more diversified types of materials. These include cans, drums, or other chimed bottom containers and wooden crates or pallets with bottom slats, and materials with flat rigid surfaces. A selection of eight frame widths, up to 36 in., is available.

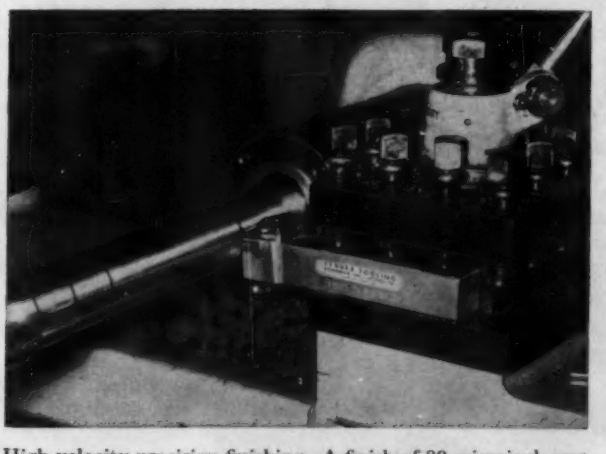
The Rapids-Standard Co, Inc, 342 Rapistan Bldg, Grand Rapids 2, Mich

MORE DATA? Circle 116, inside back cover

High metal removal on 1045 steel forging, utilizing full 100 horsepower of machine. Feed .040″; speed 420 sfm; depth of cut ¾″; insert, Kennametal Grade K21; tool, Kennametal BRH-32 Clamped Type.



Tape-controlled operation to turn and thread a part from hex stock. Four Kendex tools, including profiling and roller turner tools, were used. All tools were gage-preset. Thread chasers were made of Kennametal. Material, SAE 1115; feed .021″; speed 550 sfm; depth of cut, variable.



High velocity precision finishing. A finish of 30 microinch was developed with Kennametal Grade K165 as compared with a 60 microinch finish obtained with ceramic cutting insert used at the beginning of the show. Feed .005″; speed 1300 sfm; depth of cut .015″; tool, Kendex Dial-A-Breaker DTAR-16A.

KENNAMETAL* cutting tools match every advance in machine design

At the recent Machine Tool Show, Kennametal carbide tools and inserts demonstrated their high quality and consistency on dozens of different metal cutting machines and operations . . . such as the three shown here.

When you invest thousands of dollars for the newest, high speed numerically controlled machines, you expect to increase production, improve products and reduce costs. And you well know, the profitable return on your machine investment depends largely upon the tooling . . . tooling with predictable life . . . tooling that keeps machines producing.

From our versatile Kendex* line, including the new Dial-A-Breaker, you can get the correct tooling for your specific requirement. There are 110 standard styles, and over 400 tool holders ready and waiting for you to make your selection. If required, we will be glad to help you develop special heads with Kendex throw-away inserts to permit several operations to be performed in one pass.

Over 100, thoroughly trained Kennametal carbide engineers and servicemen provide on-the-job analysis and recommendations. And, of course, our headquarters research, engineering and manufacturing facilities are available to complement our field engineers.

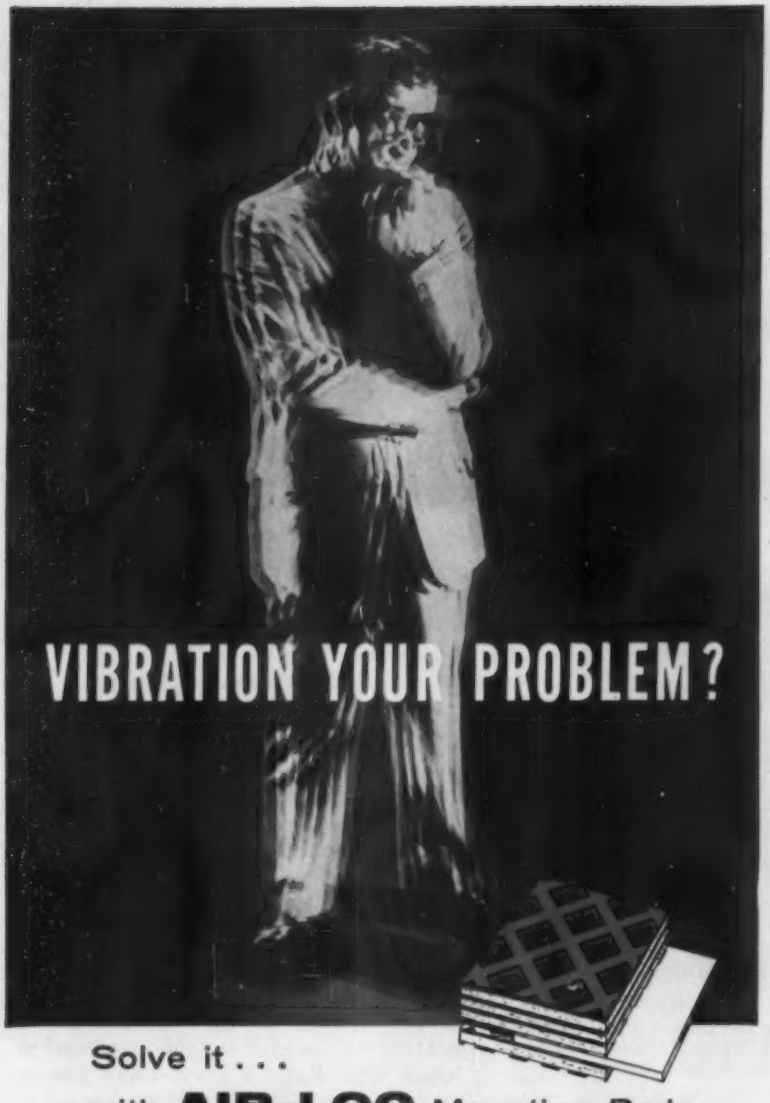
To get the most productive tooling for maximum production, from the latest type of tape controlled machine or from an older model, call your nearest Kennametal Representative . . . or write direct to KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark

33556

INDUSTRY AND KENNAMETAL ...Partners in Progress

A modern and effective solution



Solve it . . .

with **AIR-LOC** Mounting Pads

For isolating and dampening vibration, Air-Loc is the answer. In actual production tests, it successfully reduces vibration up to 85%. Air-Loc is easy to install in a matter of minutes. It can be quickly shimmed for leveling, gives permanent machine alignment . . . and is re-usable.

The scientific cross-grid embossing of Air-Loc machinery pads literally anchors your machines to the floor . . . without cement, without bolts.

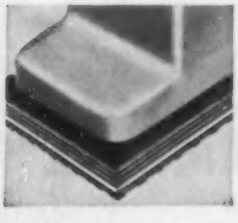
Air-Loc is made of three materials, and each plays its part in giving you the ultimate in easy, yet positive machine mounting:

Cork — absorbs vibrations, shock and noise. The cork used in Air-Loc is specially processed, under patents, to bring out its best physical properties.

Sisal Fibre — selected long-fibred sisal adds strength and stability.

Vinyl — completely surrounds the cork and sisal to give exceptional durability and permanent resistance to oils, alkalies and acids.

Write today for full information and sample.



Air-Loc® DIVISION

Clark, Cutler, McDermott Co.

100 WEST CENTRAL ST. • FRANKLIN, MASS.

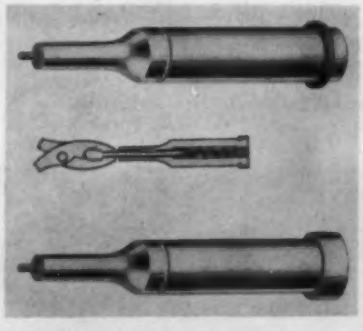
Palm-Operated Press Button Designed for Stamping Presses

Available for mounting in a machine cavity or in its own oil-tight enclosure, the unit has heavy-wall diecast construction to take the most rugged service. Pushbutton surface, over 7½ sq in., is extra thick to provide long life. Button travel is ⅛ in.

Standard button is equipped with a non-telegraphing single - pole double-throw snap switch, but is also available with two switches for double-pole double-throw action when required. Key lock is provided for by-passing the button if desired.

Square D Co, 4041 N Richards St, Milwaukee 12, Wis

MORE DATA? Circle 117, inside back cover



Pull-Pin Ejector Punches Reduce Grinding Time

Use of these punches eliminates need for disassembly or removal of stripper plates. Ejector pin is removed rapidly with pliers, punch is sharpened, and pin is pushed back in. Made of M-2 Hi Speed steel, punches are available in all point shapes, head or ring-types, with diameter 3/16 to 1 in.

Ring Punch & Die Div, Producto Machine Co, Jamestown, NY

MORE DATA? Circle 118, inside back cover

A modern and effective solution

to machining problems connected with the manufacture of Heavy Engines, Turbines and Rolling Mills

New Milling & Boring Machine FBWS

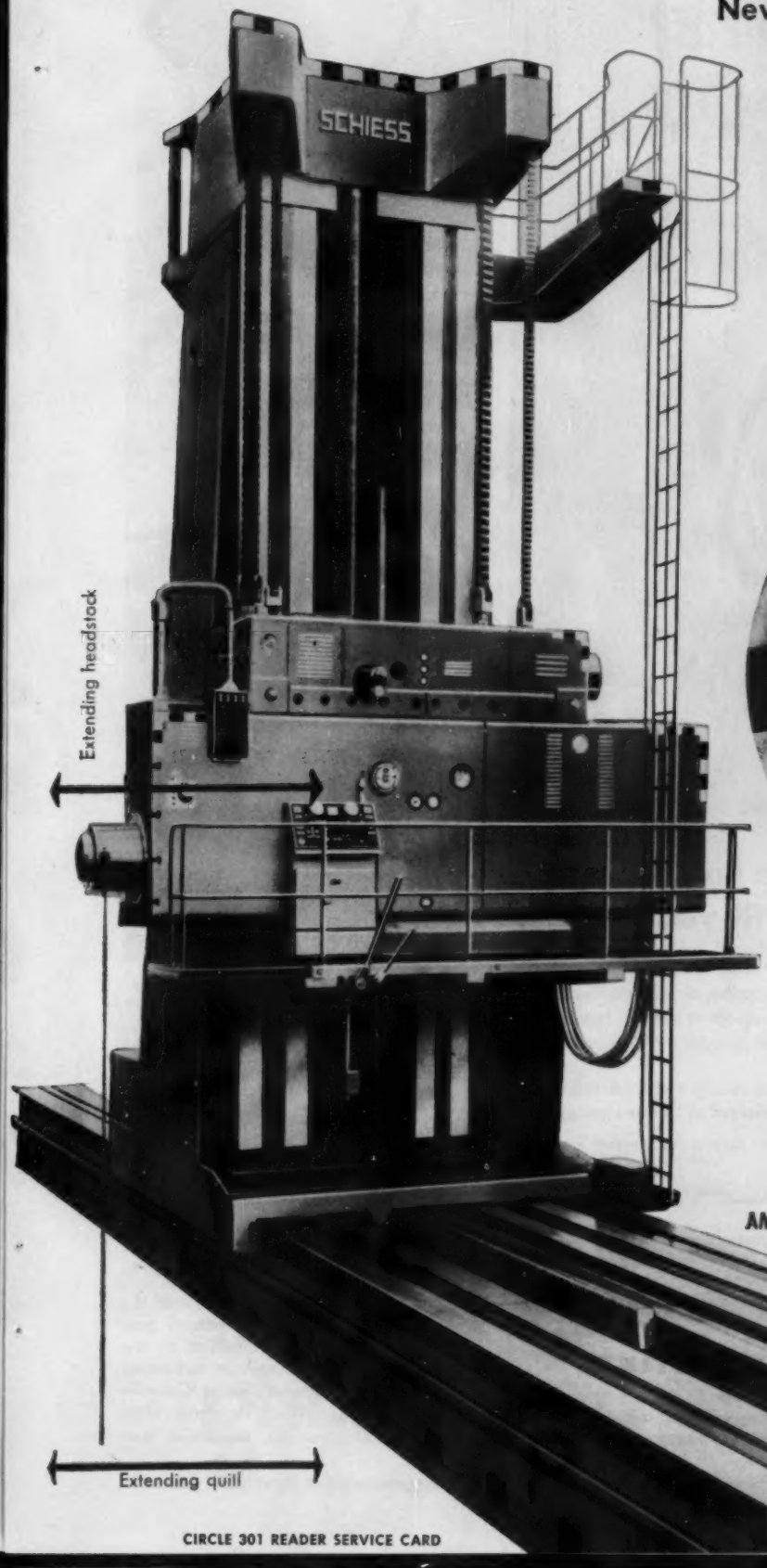
with extending headstock and quill

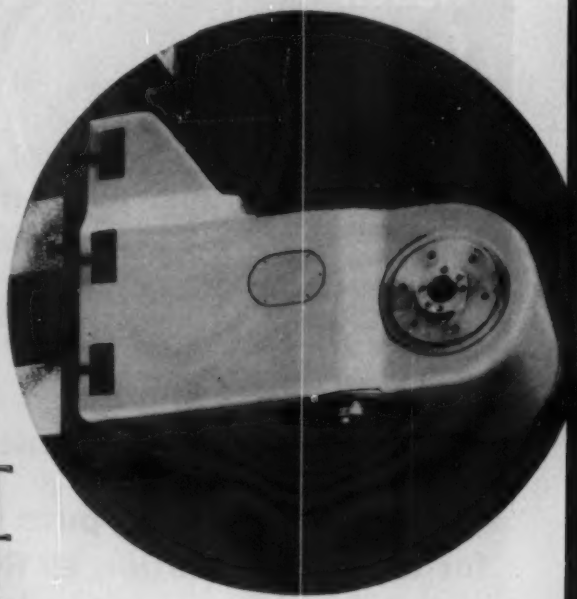
Automatic tool relief

Milling spindle can be slightly inclined in 4 directions to avoid drag on the cutting tools

Especially long extension for headstock and quill

Headstock with built on angle milling head for four tools





Dia. of milling spindle	12⅛ ins.
Dia. of boring spindle	7⅞ ins.
Dia. of quill	20⅛ ins.
Headstock extension	5 ft. 3 ins.
Quill extension	2 ft. 3 ins.
Boring spindle feed	4 ft.
Vertical traverse of headstock	16 ft. 6 ins. (more if required)
Horizontal traverse of column along bed	49 ft. 3 ins. (more if required)

AMERICAN SCHIESS CORPORATION, PITTSBURGH / PA.

6243

CIRCLE 301 READER SERVICE CARD

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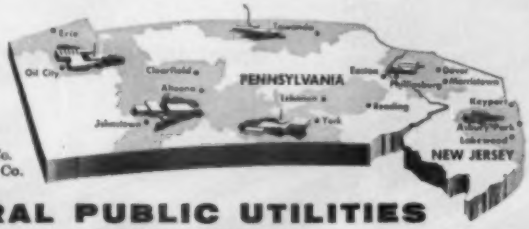
Take the "scatter-shot" out of site-seeking with GPU *Site-Service!* This complete, centralized service has complete details on more than 600 separate listings of available buildings and sites. It can do your screening for you and match *your* requirements in one of the nation's finest industrial areas.

To make sure your next plant is placed *exactly* right for most profitable operation, contact GPU *Site-Service* today! Your inquiry will receive prompt, *confidential* attention.

GPU ELECTRIC POWER COMPANIES

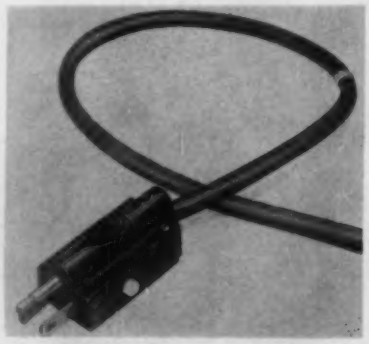
Metropolitan Edison Co.
Pennsylvania Electric Co.
New Jersey Power & Light Co.
Jersey Central Power & Light Co.



GENERAL PUBLIC UTILITIES CORPORATION

Att: Wm. J. Jamieson, Area Development Director, Dept. AM-4
80 Pine St., New York 5, N. Y. WHitehall 3-5600

NEW SHOP EQUIPMENT



MOTOR PROTECTOR for small motors attaches to end of a cord and will automatically cut off power when machine is overloaded or overworked. Button instead of fuses is used to reset the circuit breaker. Available from 3 to 10 amp—*Modern Mfg Co, 680 Davisville Rd, Willow Grove, Pa*

MORE DATA? Circle 119, inside back cover

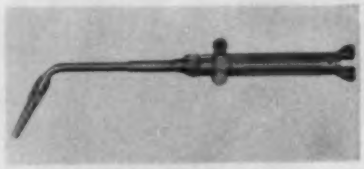
Resistance Welding Holder Kits Cover All Possible Setups

Newly developed resistance welding holder kits are said to cover all welding setups possible with standard holders, adapters, and electrodes, and at a lower cost than the individual fixtures. They are especially designed for the small shop with many short-run welding jobs.

Eleven kits are available; from three to nine setups are possible, depending on the kit. Prices range from $22.63 to $126.27.

Mallory Metallurgical Co, Indianapolis 6, Ind

MORE DATA? Circle 120, inside back cover



BRAZING TORCH, No. 19-S with the 1390 H tip for use with natural gas, will operate on high, medium, or low pressure and produces an extremely hot but clean flame—*Harris Calorific Co, 5501 Cass Ave, Cleveland, Ohio*

MORE DATA? Circle 121, inside back cover

"THIS GEAR WILL GIVE MY DRIVE HIGHER SPEED PLUS LONGER LIFE..."

Utilizing the modern facilities in our newly equipped plant, higher speed and longer life are just two of the advantages that you will get with Philadelphia's revolutionary precision grinding technique. Very often these advantages are available at no more initial cost than conventional gearing.

HIGHER SPEEDS

Dynamic load factors are materially reduced. Your equipment can operate at higher speeds with increased load carrying capacity.

LONGER LIFE

Extreme accuracy of profiles, profile spacing and surface finish eliminates "running-in" periods and resulting wear.

REDUCED NOISE AND VIBRATION

Reduced tooth to tooth errors, accumulated pitch errors, and total composite errors give smoother contact . . . reduce noise and vibration.

REDUCED BACKLASH

Precision ground gearing means reduced backlash for reversing drives . . . plus uniform backlash where precision of movement is important.

100% INTERCHANGEABILITY

Duplicate units or spares can be installed with original manufacturing tolerances duplicated exactly.

FOR MORE INFORMATION

. . . investigate this modern technique. Send for our new bulletin, AN ADVANCED CONCEPT IN MODERN GEARS.

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King of Prussia (Suburban Philadelphia), Pennsylvania

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Filter Traps Particles As Small as One Micron

The Bell C-4510 for oil, coolant, and hydraulic lines filters up to 300 gal of fluid per hour. It is 12 in. in overall height, 9 in. in diameter, weighs less than 10 lb.

Fluids passing through are forced through multiple layers of diatomaceous earth powder and fine mesh monel screen. The combination of natural and mechanical filtering elements traps suspended solids and foreign particles down to the size of one micron. Compact size and light weight make it easy to install in small space between the pump and coolant outlet, or in any oil or hydraulic line.

Wire Cloth Products Inc, 2801 Congress St Expressway, Bellwood, Ill

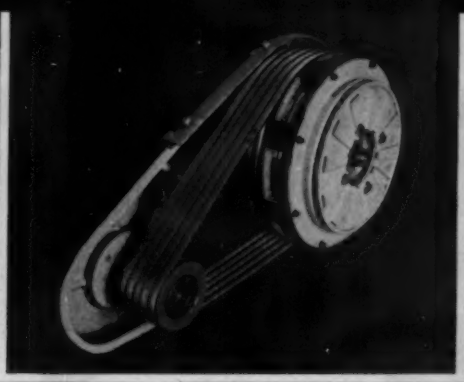
MORE DATA? Circle 122, inside back cover

Double-Action Tap Driver Works On Multiple-Spindle Machines

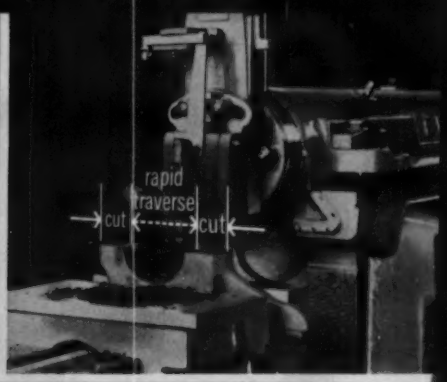
This new double-action tap driver, which was designed primarily for use on multiple-spindle machines which take adjustable-adapter shank tools, is a two-in-one tool which compensates for a difference in the feed of spindle and lead of tap. It can be used both as a tension and a compression-type driver.

When the spindle feed is less than lead of tap, the tension feature is used; the compression feature is used

1. This 2" cut, .030" feed, proves the ability of the Cincinnati's 50 psi automatic lubrication to maintain oil films under the heaviest loads.



2. Brushless electromagnetic brake and clutch insure fast, easy operation of the ram without grab. They never need adjustment.

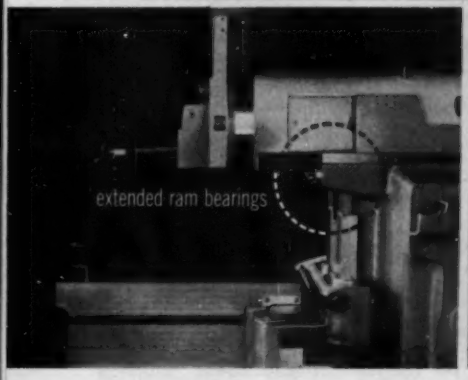


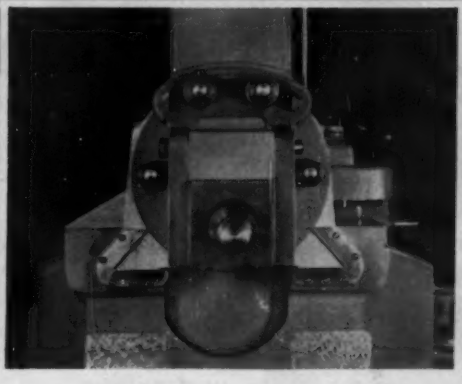
3. Both vertical and horizontal rapid traverse are standard Cincinnati features which profitably reduce time between each cut.

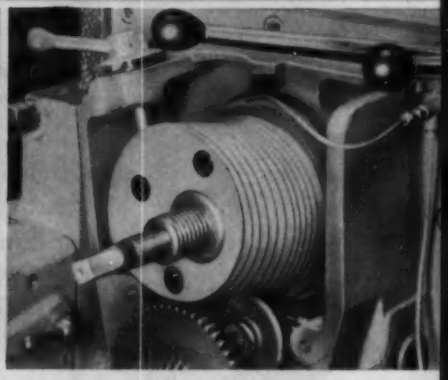
4. Extended ramway bearings increase ram support and minimize wear. Full table clearance to column provides the closest-coupled combination in the field.

5. Solid ramways, free of joints, hold the accuracy of Cincinnati shapers longer than others. Vee ways are cast integrally with the column for extra strength.

6. Individual cams for each feed, with follower always in contact give you a smooth (instead of a "bump") feed; results in superior finish on every job.







payoff features

MAKE CINCINNATI® SHAPERS YOUR BEST CHOICE

CIRCLE 305 READER SERVICE CARD

Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

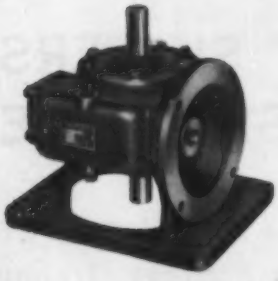
In Scotland: The Cincinnati Shaper Co., Ltd., Glasgow

956

different
motorized
speed reducers

available from stock

Yes! 956 different combinations of Perfection Motorized Worm Gear Speed Reducers are available for immediate delivery, *from stock*. Ratios range from 5 to 1 to 60 to 1, in capacities from 1/6 H.P. to 5 H.P. Perfection "C" Flange Reducers may be ordered complete with motor or without motor, to be used with a motor *of your own choice.*



Flanged motor reducers offer the maximum in compactness, rigidity and adaptability. Through the use of standard NEMA face mounted motors, complete interchangeability between motors is provided. Motor maintenance is possible without disturbing the drive and reducer. Motor assembly is fast and positive with no alignment problems.

Write for your free copy of our new 28 page catalog containing illustrations, charts and tables to help you choose the right Reducer for your particular application. Ask for Bulletin No. M-140.

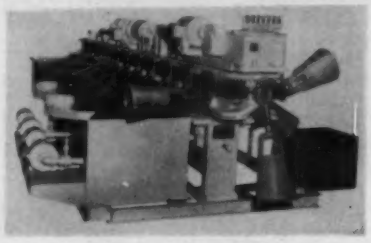
Licensed under Pat. 2,868,031

AMERICAN STOCK GEAR DIVISION
PERFECTION GEAR COMPANY, HARVEY, ILLINOIS

when spindle feed is greater than lead. The tap follows its own lead without damaging the thread because of a sensitive spring. The driver is made in six adapter sizes: ½, ⅝, ¾, ⅞, 1 1/16, 1⅜ in.

Seibert & Sons, Inc, Chenoa, Ill

MORE DATA? Circle 123, inside back cover



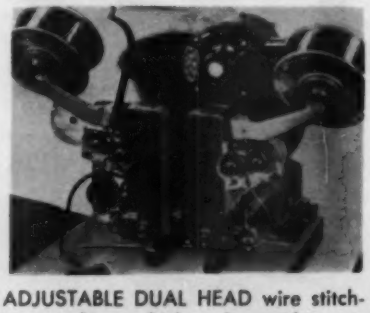
Barrel Machine Does Plating And Processing of Small Parts

Measuring only 4 feet high and 6 feet wide, this new barrel machine, which is completely automatic, does the precision plating and processing of small parts. In addition to its small size and automatic load, unload and cycling features, the Little Steve offers many other advantages to platers and processors of small, intricate parts.

Designed for incorpration into integrated process manufacturing, the machine can be quickly adapted to meet most processing requirements. An exclusive selective skip track feature permits elimination or addition of any processing step by simple mechanical adjustment. Built-in dryers are also available as optional accessories.

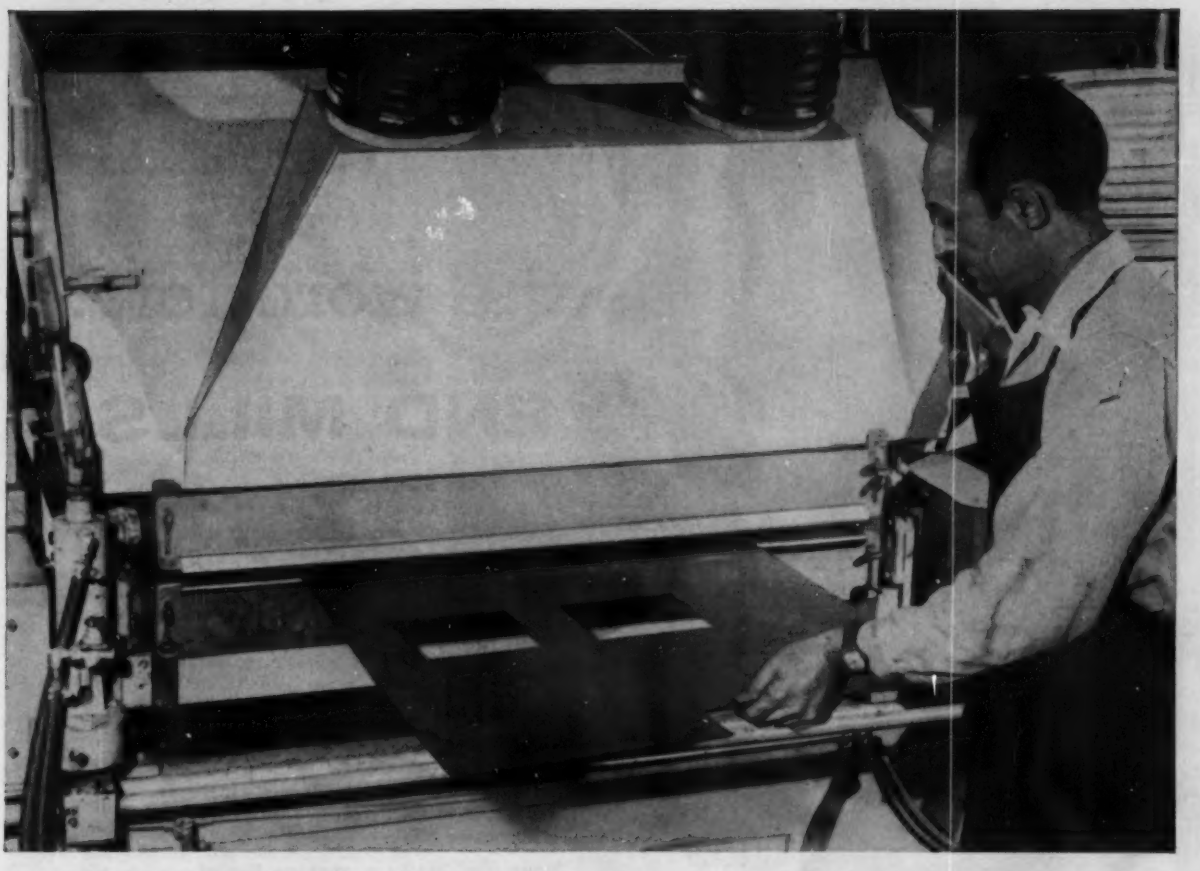
Frederic B Stevens, Inc, 1800 18th St, Detroit 16, Mich

MORE DATA? Circle 124, inside back cover



ADJUSTABLE DUAL HEAD wire stitching machine, which makes and inserts two staples simultaneously from coils of wire, fastens materials up to ⅜-in. thick. Heads can be adjusted from 3¾ to 9 in.; machine is portable and has throat depth of 10 in.—*General Staple Co, Dept R, 28 E 22nd St, New York 10, N Y*

MORE DATA? Circle 125, inside back cover



3M Abrasives Help AMF Reduce Sheet Metal Deburring Costs

Innumerable ferrous and non-ferrous sheet metal components are manufactured for cigarette, cigar, bakery, and Automatic Pinspotter Machines at the American Machine & Foundry's Brooklyn, New York plant. Sheared to size and punched, components must then be deburred and cleaned prior to painting and plating. The previous method, using abrasive discs, often left swirl marks which had to be removed in a secondary hand sanding operation at extra cost.

As the result of a recommendation from a 3M Representative, AMF switched to the use of a wide-belt sander and "Three-M-ite" Resinbond Cloth Belts on these operations.

The results were remarkable. The new wide-belt prefinishing method eliminated all extra re-work, provided a better pre-paint surface, and cut unit costs substantially. Unit production time was slashed from more than 9 minutes to less than 30 seconds.

Why not let 3M's new COST CHECK 5-4-5 Program help you to effectively investigate ways to lower costs and increase profits. Discover . . .

- If your grinding can be done more economically
- If your finishing is as efficient as possible
- If your polishing can be done faster and better

Send today for a free COST CHECK 5-4-5 Review Form *without obligation.* Put 3M's years of abrasive know-how at your disposal.

3M Coated Abrasives

SEND IN TODAY

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Send me my Free COST CHECK 5-4-5 Kit

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MINNESOTA MINING AND MANUFACTURING COMPANY

. . . WHERE RESEARCH IS THE KEY TO TOMORROW

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"3M" AND "THREE-M-ITE" ARE REGISTERED TRADEMARKS OF 3M CO., ST. PAUL 6, MINN. EXPORT: 99 PARK AVE., NEW YORK 16. CANADA: LONDON, ONTARIO.

Super is the word for...

Super END MILLS

Super Tool's End Mills are specifically manufactured to meet the highest standards of quality workmanship and rugged, long-lasting performance.

Super carries a complete line of solid Carbide and Carbide tipped mills with 2, 3, or 4 flutes, straight or tapered shanks. Each End Mill is selected for the best possible performance on all materials.

Super Shear End Mills feature Carbide tips that run uniformly the full length of each high helix angle flute. This design assures cleaner, smoother cutting action and in turn, requires up to 25% less machine power.

Super Tool stocks a complete line of End Mills, or, they will make them to *your* specifications. The last word . . . for the finest performance on your milling operation . . . is SUPER TOOL! BACKED BY PROVEN PERFORMANCE IN THE FIELD!

SUPER . . . THE TOOLS THAT TESTIFY IN THEIR OWN BEHALF . . . BY GIVING LONGER LIFE AND PRODUCING AT LOWER COST.

Super TOOL COMPANY
Division of Van Norman Ind., Inc.

SUPER TOOL COMPANY
21650 Hoover Road • Detroit 13, Michigan

Optical Gaging Products Acquires Detroit Firm

Assets of Automated Reproductions Co, Detroit developer of methods and equipment for plastics etching on plexiglass, vinyls, butyrates, and styrene, have been acquired by Optical Gaging Products, wholly owned subsidiary of Ex-Cell-O Corp. Plans are being made to transfer the operation to Optical's plant in Rochester, NY. Optical Gaging is the marketing outlet for the contour projectors that Ex-Cell-O acquired from Eastman Kodak early this year. In addition, it is a developer of optical gaging techniques, and a designer and manufacturer of gaging equipment.

Thomson Electric Welder Sets Up Leasing Plan

A financing plan that'll allow purchasers of resistance welding machines the option to lease instead of buy has been set up by Thomson Electric Welder Co, Lynn, Mass, and General Electric Credit Corp (the holding firm), and has been incorporated into the company's sales structure. Plan is similar to those currently in use in the machine tool field. Welding machines, either standard or modified slightly to suit a customer's requirements, are leased for a maximum of 60 months. Numerous options are available including straight time payment arrangement in which a customer obtains title to the unit.

$181 Million Order to Lockheed

Lockheed's Missiles and Space Division has a Navy contract for speed-up development of longer-range versions of the Polaris missile. This 1961 fiscal year extension of Lockheed's Polaris R&D contract brings to approximately $608 million the funds awarded to the firm for work in this field since 1956. Top-priority development of extended versions of Polaris will match the highly accelerated program which has enabled Navy to shave three years off the original Polaris timetable, according to Herschel J Brown, vice president and general manager of the division.

Automatic cleaning of jet engine parts is done by this huge machine at the new jet engine overhaul shop of United Air Lines in San Francisco. Parts are stacked in metal baskets and carried by monorail into the unit for cleaning and rinsing. Built for United by Ransohoff Co of Hamliton, Ohio, the machine is operated by mechanic at console (right)

American Business Expected To Up Overseas Investments

Department of Commerce reports that American companies expect to invest $3.8 billion this year in facilities abroad as compared with last year's $3.7 billion. Peak year was 1957 with outlays of $4.8 billion. Canada remains the area of heaviest American investment. Capital spending there by American concerns is expected to edge upward this year to $1.2 billion, representing a gain of $30 million over the 1959 level. Europe will show the biggest gain in American investment. Spending there, according to the report, would increase from the 1959 level of $881 million to almost $1.1 billion. Capital spending in Latin America is expected to show a decline to $874 million from $1,044,000,000.

AMF Expanding in Buffalo

American Machine & Foundry Co's Buffalo Division, one of the major defense businesses on the Niagara Frontier, is leasing 95,000 sq ft of space in the former Sylvania plant. It'll be AMF's third facility in this area and will have 400 employees. The Buffalo Division has a $50 million defense backlog, most of it work in connection with launching systems for the Atlas Titan, and Sergeant missiles. Employment is up to 1600 and is scheduled to reach a peak of at least 1800 by January or February.

Ling-Temco Forms New Unit

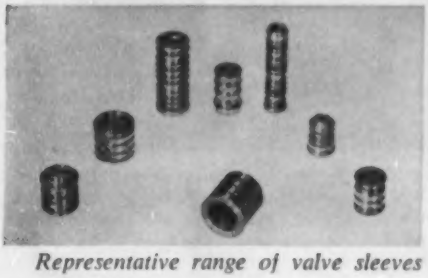
Ling - Temco Electronics, Dallas, Texas, has formed a Micromodular Components Division which will de-

McGIRK'S WORKS by GEO. CRENSHAW

NOW, THAT'S WHAT I CALL REAL SPUNK! HE DIDN'T ASK FOR A RAISE; HE DEMANDED A RAISE!...
THERE'S A MAN WHO TAKES THE BULL BY THE HORNS!.... A REAL GO-GETTER!
YESSIREE!... A SMART YOUNG FELLER LIKE THAT IS REALLY GONNA GO PLACES!...
FIRE HIM!
MOE'S CORNER
When you're changin' jobs a lot, ya gotta travel light.

WHY MICROHONING* helps Hawk Guidance System "think" straight

The Army-Marine surface-to-air Hawk missile is the first of its kind to overtake and destroy a ballistic missile in a simulated enemy attack. Designed by Raytheon's Missile Systems Division, it is being built at their Andover, Massachusetts plant.



Representative range of valve sleeves Microhoned.

MICROHONING GENERATES ACCURACY

With consistent accuracy as a prime requisite, Raytheon engineers specify Microhoning in the processing of valve sleeves and blocks used in the servomechanism that guides the Hawk in its supersonic flight. Microhoning of bores rectifies geometric inaccuracies, size is held within .0003", roundness within .0001" tolerance, and a surface finish of about 8 microinches (rms) is generated.

MICROHONING'S VERSATILITY

Thirteen different sizes of sleeves and blocks are Microhoned, including those with blind-end, interrupted, and ported bores. Parts, which are generally of stainless steel heat treated to 58-60 R "C", have bore diameters ranging from .171" to .874" and lengths from .594" to 2.859".

STRAIGHT, CLEAN BORES

Microhoning of these components effectively corrects camber or bow in the bore and assures less smear around the ports than possible with any other machining method. Bore camber and smear could cause binding or a hindering action between the sleeve and its spool, and thus throw the missile off-course.

The strong emphasis on precision can best be appreciated in the realization that sleeves and mating spools must operate within a clearance of only 100 to 150 millionths of an inch. The fit of the spool within the sleeve must prevent blow-by. A final lapping operation provides geometric accuracy within .000050" tolerance.

For further details, see facing page.

**Registered U. S. Pat. Off.*

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

sign, produce, and market logic circuitry modules for transistorized computers, custom semi-conductor assemblies, and high and low voltage rectifiers. The division will be one of the industry's first organizations of its size devoted exclusively to applications engineering of reliability, according to President James J Ling.

Lycoming Gets More Missile Work

Avco Corp's Lycoming Division in Stratford, Conn, has contracts totaling $4.4 million for production of additional missile rocket chambers. Received from Aerojet - General Corp, Sacramento, Calif, the orders extend current production of rocket chambers for the AF Minuteman ICBM. Aerojet holds contracts for development and production of the second stage engine for Minuteman. Lycoming has been producing second and third stage rocket chambers since early 1959; under terms of the new contract some of the chambers will be produced by hydrospinning, others will continue to be turned out by current conventional machining processes.

Aerojet-General Buys Control Of Space Electronics

Aerojet has purchased a controlling interest in Space Electronics Corp of Glendale, Calif, from Pacific Automation Products Inc of which SE has been a subsidiary. Purchase was made, according to Aerojet spokesman, because of SE's technical capabilities in the field of communication and guidance which would supplement the work of Aerojet's own recently expanded Spacecraft Division.

Chance Vought Aircraft . . .

. . . is changing its corporate name to Chance Vought Corp to more clearly reflect its present diversified operations. In addition to its aircraft business, the company is functioning in such fields as electronics, astronautics, industrial automation, business data processing, mobile homes, and missile and satellite range systems.

Robertshaw-Fulton Expands

New Robertshaw Thermostat Division manufacturing plant has been opened near Youngwood, Pa. The $4 million facility, which manufactures principally gas appliance controls, has seven and a half acres un-

der roof, providing a total of 360,000 sq ft of working space.

Company has had its corporate headquarters in Richmond, Va, since 1957 when it moved from Greensburg, Pa. It's planning to put up a new headquarters building in suburban Richmond. Construction is expected to start in the late spring or early summer of 1961 and to be ready for occupancy a year later.

Douglas Gets New Nike Zeus Order

A $60 million contract has been awarded to Douglas Aircraft for continuing research and development of the Nike Zeus antimissile missile. Funds are Douglas' portion of a $199,125,000 supplemental contract previously awarded Western Electric Co by Army for continuance of the weapon system development for another 12 months. Western Electric is prime contractor on the system for which Bell Telephone Laboratories has R&D responsibility. The Douglas portion of the program includes development of the missile itself and related handling, testing, and firing equipment.

Tartar Contract to Convair

Convair (Pomona) Division of General Dynamics Corp has a $41.3 million contract from the Bureau of Naval Weapons for production of the Tartar supersonic surface-to-air guided missile. Tartar is produced at the US Naval Weapons Industrial Reserve plant at Pomona, Calif.

(continued on p 228)

"First thing, he'll ask me if I'm Charles Murray. It's a little joke he has when he finds me working at my machine."

HOW MICROHONING corrects camber in components of Hawk Missile

Raytheon, designer and builder of Hawk missiles, is constantly seeking to improve processing methods and attain greater precision-production. One example of this is the processing of valve sleeves and blocks used in the steering mechanism of Hawk missiles. Here's how Microhoning corrects bore camber, minimizes smear around ports, generates geometric accuracies and microinch surface finishes.

CORRECTING BORE CAMBER

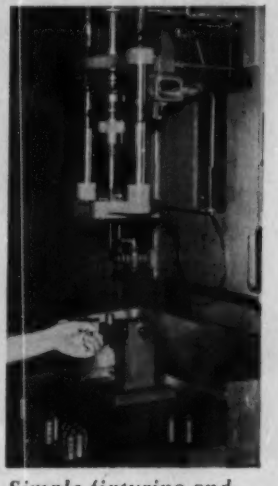
To straighten bore surfaces so that they are parallel throughout their length to the neutral axis of the bore, Microhoning utilizes the combination of: abrasive sticks of exact length, positive radial expansion of abrasives, and controlled rotating and reciprocating motions of the Microhoning tool.

Each Hydrohoner has automatic *size control, stonefeed and stonewear compensation.*

MINIMUM SMEAR AT PORTS

Thirteen different sizes of sleeves and blocks are Microhoned, including those with blind-end, interrupted, and ported bores.

The Microhoning characteristics of low-velocity abrading and constant widespread contact with bore surfaces eliminate more smear around the ports than is possible with any other machining method.



Simple fixturing and hand loading are part of this careful processing.

EFFICIENT PRECISION PROCESSING

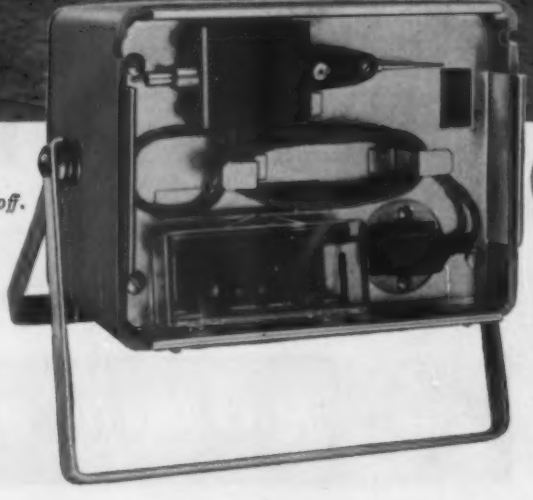
In two Microhoning operations, from .002" to .006" stock is removed from the bores at an approximate rate of .001" per minute. The rough Microhoning removes from .001" to .005" stock while correcting camber to within .0003". The finish Microhoning rectifies geometric inaccuracies resulting primarily from heat treating of parts. Size is held within .0003", roundness within .0001" tolerance, and surface finish generated is about 8 microinches, rms.

For further details, see facing page.

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

NEW, Improved

electro-probe . .



Rear view with cover off.

NEW

CONVENIENT PACKAGING

Housing of amplifier is carrying case for gage. Gage head can be removed and mounted without disturbing plug connection, and cover replaced while head is in use. Battery beneath panel is easily removed. The small plastic box contains holding and mounting accessories.

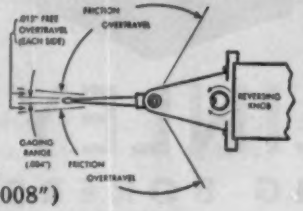
. . LOW COST PORTABLE ELECTRONIC GAGING UNIT

Now more compact, more versatile, easier to use . . .
Many new features.

FEATHER-LIGHT TOUCH Extremely low contact pressure — less than 2.5 grams — so light you can gage dependably to high accuracies in the shop without using heavy weight stands. Electro-probe can be used with test set stands or even more conveniently with new, low cost, wide range height stand illustrated.

UNIFORM GAGING PRESSURE Unique gage head design permits constant pressure throughout range (change is less than 0.1 gram per .001″ of contact travel in either direction). Pivot located so that *magnification remains constant* with changes in contact position.

NEW **NEW CONTACT TIP DESIGN (Patent applied for)** New involute curve form of tip permits accurate measurements, even with finger at 20° angle to work. No need to apply correction factors as with other lever-type gage heads.



NEW **WIDE CHOICE OF GAGE HEAD POSITIONS** Contact can be positioned anywhere within arc of over 200° and is clutch-mounted for complete overtravel protection. Small tip on contact lets you check where other electronic gages cannot.

NEW **DUAL RANGE ZERO ADJUSTMENT** Two-speed knob provides unique arrangement for both long range electrical zero adjustment (over .008″) and fine setting. Simplifies set-up and makes precise mechanical positioning unnecessary. Each Electro-probe has two ranges (± .002″ and ± .001″ for one model and ± .001″ and ± .0002″ for the other). Other magnifications available. Scales are correlated; zero setting will not change when switching magnification.

NEW **BATTERY LIFE QUADRUPLED** New transistor amplifier design gets 1200 to 1300 hours' life from mercury cell battery (up to 2 years' operation in normal use) — more than four times that obtained by previous model. Can also be operated from pen size mercury cells or . . . in emergency . . . regular carbon-type batteries. Where use is continuous, a battery eliminator can be furnished for 115 volt operation.

NEW **IMPROVED METER VISIBILITY** Adjustable legs, which double as carrying handles, permit placing meter at any angle for best visibility. The fine line graduations and needle-thin pointer provide easy, precise readings. The meter is highly accurate and more rugged than previous model. Meter housing contains all amplifier components (transistors and printed circuit card) so entire unit can be easily and compactly mounted in a panel if desired.

For demonstration or brochure, write
FEDERAL PRODUCTS CORP., 61211 Eddy Street, Providence 1, Rhode Island.

Ask **FEDERAL** *First*
FOR RECOMMENDATIONS IN MODERN GAGES...
Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

Precision Operation In A Compact Design . . . Cuts Costs

LINLEY

JIG BORERS

Designed specifically for tool, model and experimental departments.

The Linley Jig Borer is accurate to a high degree. It is fast to set up and position and has the versatility required for precision tool room and die work, yet is low in cost.

Many time-saving accessories are now available for use with the improved Linley that add to its usefulness and simplify its operation.

Check on the many advantages of this improved jig borer. Table size is 7" x 17½"; table travel, 6½" x 10".

Send for descriptive literature.

LINLEY BROTHERS CO.
664 State Street Ext.
Bridgeport 1, Conn.

Twin Coach Buys York-Hoover Div

The Body Division of the York-Hoover Corp, York, Pa, has been purchased by Twin Coach Co of Cheektowaga, NY. In addition to production of truck bodies for truck fleet owners, the Division makes huge shelters for missiles, missile ground support equipment, and other defense electronic equipment, plus hydraulic and electro-mechanical devices for utility companies. It'll be operated as a subsidiary under the name York Body & Equipment Co.

Martin Gets AF Contracts

Martin Co, Baltimore, has been awarded two contracts totaling $3 million for repairs and equipment related to the Mace-B guided missile. Company will establish a central supply depot at Middle River, Md, to repair all Mace-B missiles as they are returned from overseas bases for maintenance. A hundred technicians will be hired and present facilities enlarged.

Bostitch to Build in Conn

Bostitch Inc, East Greenwich, RI, has purchased 41 acres of land in Clinton, Conn, on which it'll build a wire plant for its subsidiary, Universal Wire Co. The 100,000 sq-ft facility with a prospective 100 employees will produce a substantial part of Bostitch requirements of stapling wire and attaching wire. Universal Wire is presently located in Stamford.

Studebaker-Packard to Benefit From Raymond Loewy Slant

Raymond Loewy Associates, industrial designer, has been retained by Studebaker-Packard Corp as consultant in advance styling. Loewy, first associated with Studebaker in 1938, is renewing the affiliation and will concentrate principally on styling of automobile interiors. The firm will work in conjunction with S-P's advance styling department.

Mallory Controls Expanding

New 140,000 sq-ft plant will be constructed in Frankfort, Ind, by Mallory Controls Co, a division of P R Mallory & Co. Facility, to be located on a 45-acre tract, and designed for future expansion, will employ 550 people when it gets into full production in the spring of 1961. It'll manufacture the company's lines of carbon controls, vitreous enamel resistors, power rheostats, switches, jacks and plugs.

New Special Products Division Formed by Huck

Huck Manufacturing Co, Detroit, has established a new marketing and manufacturing division to produce close tolerance cold headed and roll-formed parts on special order. Company has been producing close tolerance fasteners for a wide variety of metalworking applications for the last 20 years. It's equipped with cold heading and roll forming machinery for the production of parts made from wire diameters up to 1 in. in aluminum or carbon steel and up to ¾ in. in stainless. Arthur W Ackerman Jr who has been with Huck as assistant to the executive vice president since 1957 will head the new Special Products Division.

Mathews Conveyer Buys Michigan Concern

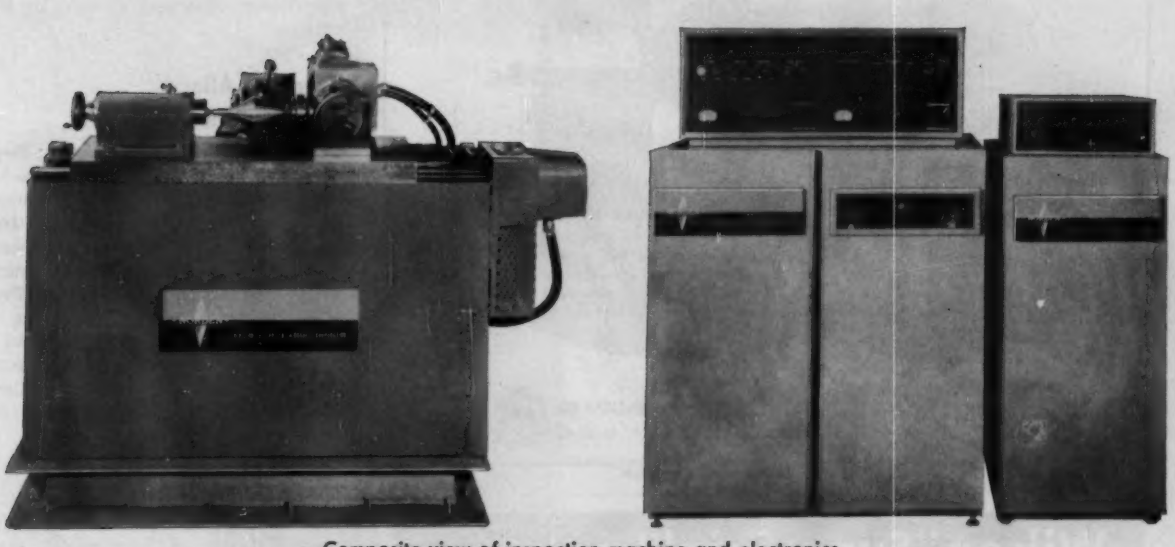
Mathews Conveyer Co of Ellwood City, Pa, has purchased the Tobert Co of Lansing, Mich, which engineers and manufactures Live-Flo oscillating conveyers. These units operate on a different principle than other oscillating conveyers now on the market and will supplement the Mathews line of power and gravity conveyers and special conveying machinery. All Tobert manufacturing operations will be moved to the Ellwood City plant immediately and the units will be sold by both of the company's subsidiaries at San Carlos, Calif, and Port Hope, Ont, as well as the parent firm.

"Well, I warned you. A nearsighted machinist with a handlebar mustache and a drill press just don't mix."

NORDEN

Modumatic Systems for Numerical Inspection

For automatic measurement of actual dimensions or deviations from nominal



Composite view of inspection machine and electronics

Norden's new concept in numerical control applies absolute digital techniques to a wide variety of inspection problems. The Norden system gives digital position information of actual part dimensions as well as deviations from nominal.

NORDEN SYSTEM

INPUT

Automatic Tape Control—Standard 1″–8 channel paper or Mylar tape

Manual Numeric Control—by ten position rotary switches–one switch per digit in decimal form

Manual Jog Control—of position servo motors by push buttons on control panel

OUTPUT

Visual Decimal Display—continuous display of absolute position, part dimensions or deviations in any axis

Printout—typewriter variable format

Punched Tape

Output can also be designed to meet specific requirements.

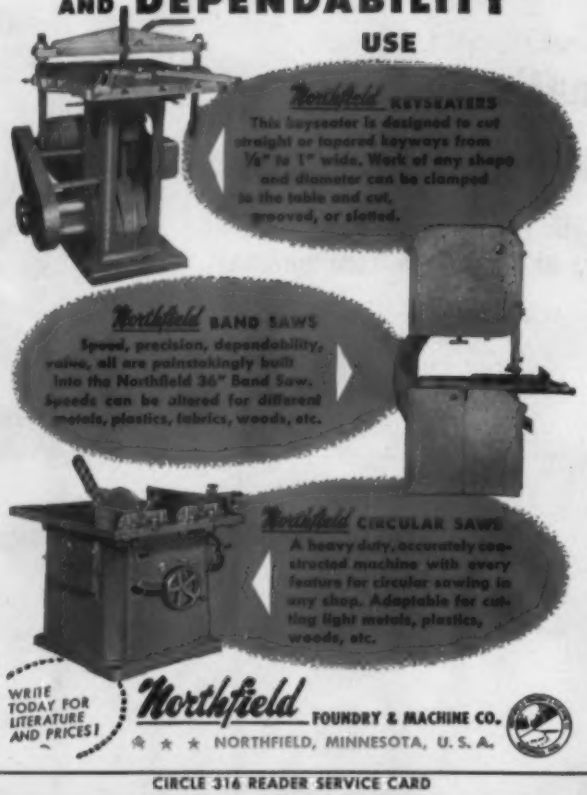
The modumatic inspection system also features full range origin selection for fast and accurate part set-up. The entire system is constructed from modules so that you may select the exact features required for your application.

For more information about Modumatic Inspection Systems or other Norden numerical control systems, contact your nearest representative–400 Main Street, East Hartford, Connecticut, JAckson 8-4811–11 West Monument Ave., Dayton 2, Ohio, BAldwin 8-4481, or write us at the address below.

NORDEN

DIVISION OF UNITED AIRCRAFT CORPORATION
DATA SYSTEMS DEPARTMENT
3501 HARBOR BOULEVARD, COSTA MESA, CALIFORNIA

FOR EFFICIENCY AND DEPENDABILITY USE



Northfield KEYSEATERS
This keyseater is designed to cut straight or tapered keyways from 1/8" to 1" wide. Work of any shape and diameter can be clamped to the table and cut, grooved, or slotted.

Northfield BAND SAWS
Speed, precision, dependability, value, all are painstakingly built into the Northfield 36" Band Saw. Speeds can be altered for different metals, plastics, fabrics, woods, etc.

Northfield CIRCULAR SAWS
A heavy duty, accurately constructed machine with every feature for circular sawing in any shop. Adaptable for cutting light metals, plastics, woods, etc.

WRITE TODAY FOR LITERATURE AND PRICES!

Northfield FOUNDRY & MACHINE CO.
★ ★ ★ NORTHFIELD, MINNESOTA, U. S. A.

CIRCLE 316 READER SERVICE CARD

Wilson "Superficial" makes Shallow Measurements Accurately

Wilson Rockwell Superficial hardness testers are used to measure surface hardness, coatings, thin metal or thin hard cases. The hardness test is based on a penetration of less than .005", and Wilson Superficial testers have the precision and ease of operation to give accurate readings every time.

Accurate—Precision-built for consistently correct results. Knife-edge bearings provide near-frictionless operation.

Easy to operate—Controls conveniently grouped—oil dash-pot system provides smooth load application.

Long lasting—Simple design, rugged construction make Wilson Superficial testers as durable as a machine tool.

Complete line available—Wilson Rockwell hardness testers and accessories are available in a wide variety for every hardness testing function. Also "Brale" diamond penetrators for perfect readings every time.

Write for details—Ask for Catalog RT-58. It gives complete information on the Superficial tester as well as on the full line of Wilson Rockwell hardness testers.

Wilson Rockwell Superficial Haraness Tester

WILSON "ROCKWELL" HARDNESS TESTERS

ACCO

Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.
230-B Park Avenue, New York 17, New York

FIELD REPORT

Eutectic's 20th Anniversary

Eutectic Welding Alloys Corp marked the 20th anniversary of its founding in the US by breaking ground for a half-million-dollar addition to its headquarters facilities in Flushing, Long Island. New building will be the third major expansion of facilities since the firm moved to Flushing ten years ago. The company and its affiliates have 16 plants and laboratories throughout the world and sales and service in 100 nations.

Vanadium-Alloys' New Department

New Cast-to-Shape Products Dept has been formed by Vanadium-Alloys Steel Co to meet requirements of industry for tool and special steel castings. Located in the main plant at Latrobe, Pa, the department manfactures sand, shell, and Shaw Process castings, plus combinations of all three. Castings are offered in a complete range of sizes from small to large in a wide variety of alloys melted to meet specific customer requirements.

Borg-Warner Acquisition

Brummer Seal Co, Chicago Heights manufacturer of mechanical seals for automotive engines, has been acquired by the Spring Division of Borg-Warner Corp. Company will be known as the Brummer Seal Division of B-W but will be operated as part of the Spring Division which produces automatic transmission components and other automotive parts and assemblies in Bellwood, Ill.

"I wear 'em to keep the chips out of my eyes."

GEARS

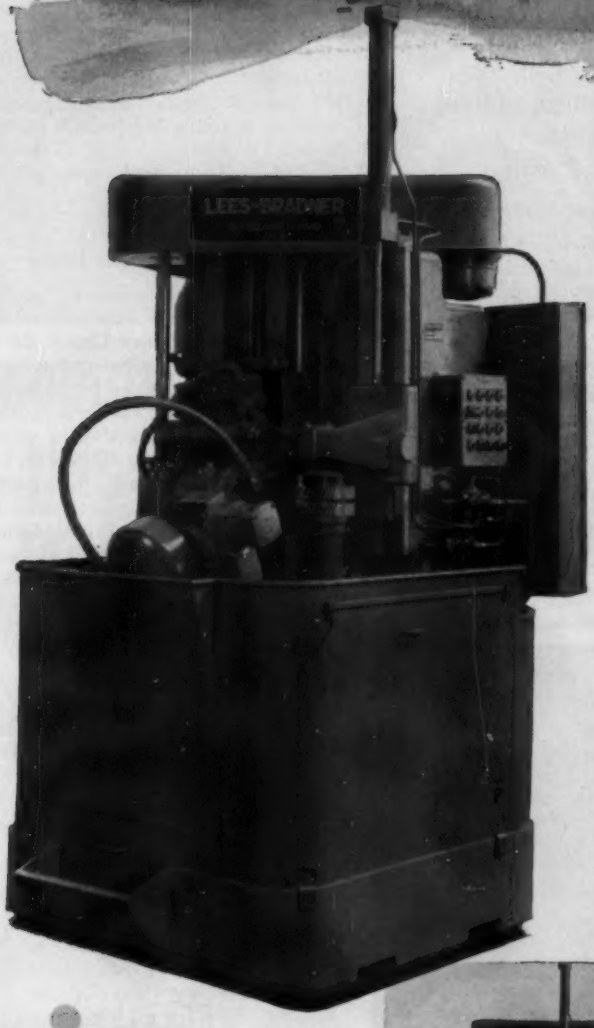
from the NEW 12-HD LEES-BRADNER

You asked for it and Lees-Bradner has built it . . . after years of design planning and months of building and testing.

This rugged hobbing machine — known as the 12-HD 12" x 20" — will produce gears up to 8, 9, 10, even 12 inches in diameter at mass production speeds. A revolutionary innovation is the new variable speed A.C. drive, using stock — *not special* — stock A.C. motors!

Now truck, tractor and earthmoving equipment manufacturers can generate heavy-duty gears as efficiently as smaller ones have been made.

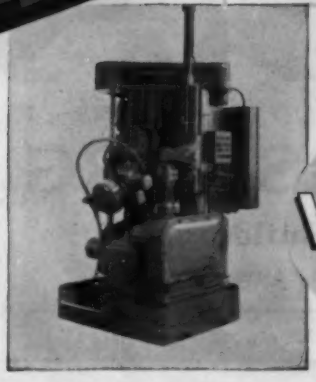
Write Lees-Bradner for all the details — or get in touch with our representative in your area.



SPECIFICATIONS

Rated capacity in steel	4 D.P.
Max. diameter capacity (with 5" hob)	12"
Max. helix angle	45°
Taper in work spindle nose	16 B & S
Floor space	60" x 60"

THE NEW 12" x 20" 12-HD
Designed to produce large, heavy-duty gears at high-production speeds.
Can be equipped with lead differential, electric hob shifter and hydraulic controls.



IMPROVING GEARS FOR 50 YEARS

the LEES-BRADNER Company
CLEVELAND 11, OHIO, U.S.A.

THE WORLD'S MOST MODERN GRAVITY DROP HAMMER--

The IMPROVED CECO-DROP

with CECO BLOWMATIC PROGRAM CONTROLLER
(illustrated below)
Pre-selected pattern of long and short strokes for Semi-automatic Forging

Other great new features:

DIE SETTING EASIER AND SAFER: by means of new ram-inching device, operator can raise or lower ram, safely at will.

FASTER ACTING ROD CLAMP: by means of new Double-acting Clamp Operating Cylinder.

WEAR-REDUCING NYLON-TIPPED KNOCK-OFF DOG: reduces shock to valve control rigging; reduces wear on ram incline.

Write for bulletins and details

CHAMBERSBURG ENGINEERING COMPANY • CHAMBERSBURG, PA.

CHAMBERSBURG

• The Hammer Builders •

DESIGNERS AND MANUFACTURERS OF THE IMPACTER

When it's a vital part, design it to be FORGED

FIELD REPORT

GE Lab Installing Vacuum Furnace For High-Temp Processing

General Vacuum Corp of East Boston, Mass, will design and construct a new, large-scale vacuum facility for the Research Laboratories of General Electric in Schenectady. The furnace, which will be one of the largest ever built, will be used for high temperature processing of space age materials under controlled ultra-pure vacuum conditions.

The equipment will provide temperatures above 4500 F and the vacuum system will operate in an area equivalent to an altitude in excess of 100 miles above the earth's surface, enabling the lab to accomplish metallurgical operations with tungsten, tantalum, and other high-temp materials on a production scale.

Skinner Chuck Changes Name

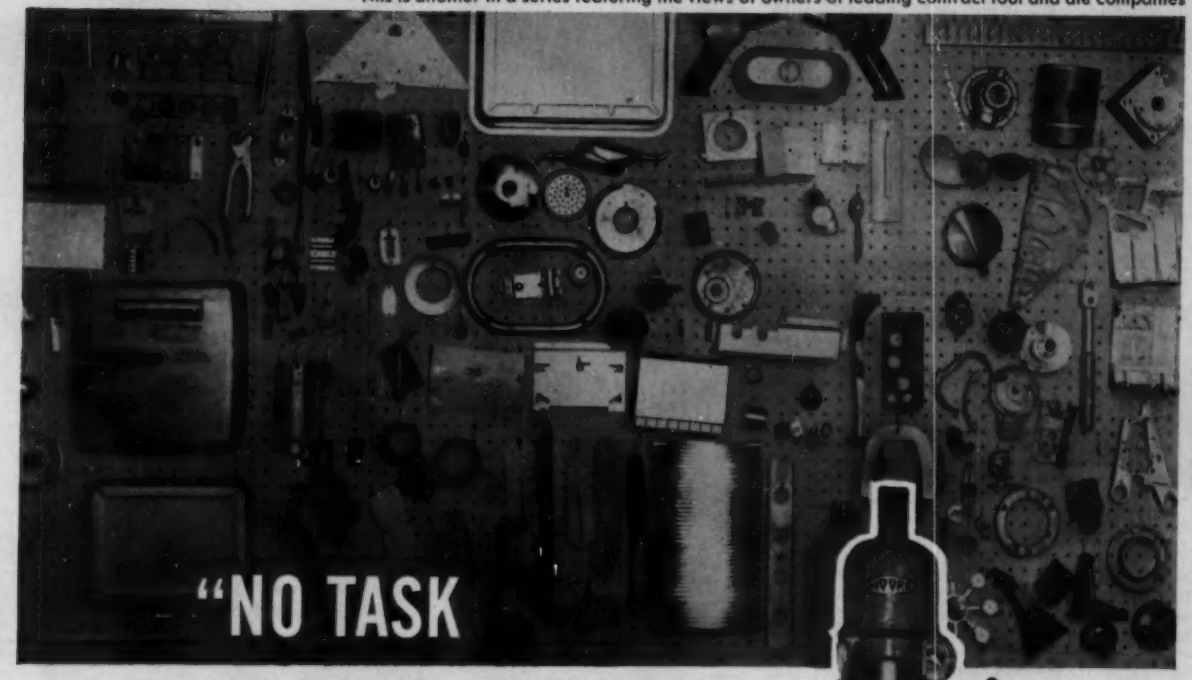
Skinner Precision Industries Inc has received stockholder approval as the new name of Skinner Chuck Co of New Britain, Conn. Change has been made to more clearly indicate the broadened scope of the corporation's present and future activities which include manufacture and sale of products not related to chucks. Company's Chuck Division will be known as the Skinner-Horton Chuck Division; name of the Valve Division will remain the same—Skinner Electric Valve Division.

Behr Serves Machines With Smorgasbord

Behr Machinery & Equipment Corp put on a machine tool show with a fresh fillip recently its Rockford, Ill, headquarters. Guests of the

"Chicken."

This is another in a series featuring the views of owners of leading contract tool and die companies

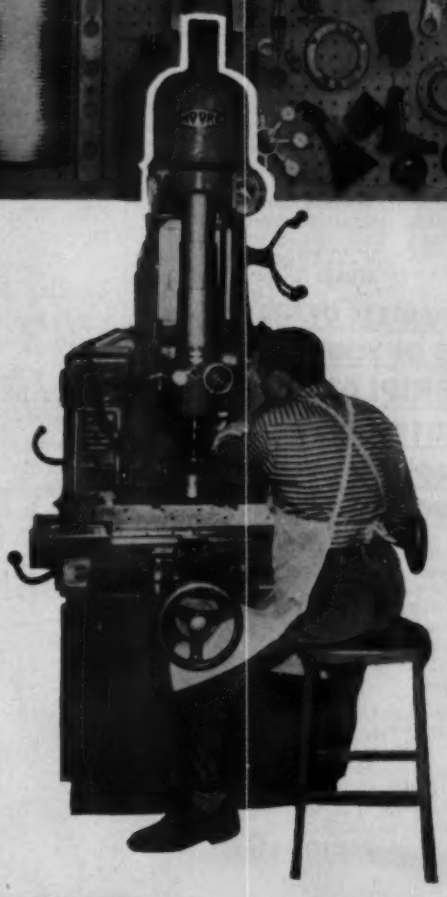


"NO TASK seems too difficult for this remarkable new Moore No. 3 Jig Borer"

...writes A. A. Zeise
of Tool Products Company, Minneapolis, Minnesota

"Our ability to offer the finest work on the best equipment has consistently rewarded us with gratifying success and steady growth during the past 13 years. With Moore equipment we have always been able to assure highest accuracy and top quality in our day-to-day toolroom work.

"And now, with the recent addition of our Moore No. 3 Jig Borer, we are hitting a new high in precision—constantly achieving tolerances of .000050 (50 millionths). Located in our temperature controlled room, no task seems too difficult for this remarkable Moore machine."

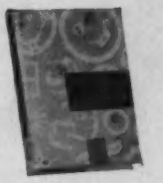


You, too, will easily break the "tenth" barrier—boring, drilling, reaming and spotting holes in dies, jigs, and production parts—with the new Moore No. 3 Jig Borer.

It offers more precise positioning tolerances...all hardened, ground and lapped ways...no gibs...no overhang...improved drive...and a speed range of 60 to 2250 RPM.

Write for illustrated brochure. Ask also for information on the new No. 3 Jig Grinder, which locates and grinds holes to less than a "tenth."

MOORE SPECIAL TOOL COMPANY, INC.
738 Union Avenue, Bridgeport 7, Connecticut



HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts the modern way. 424 pages, 495 illustrations. $5 in U. S. A., $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

"THIS LUBRICANT PRACTICALLY ELIMINATED BEARING REPLACEMENTS"

Says- C. O. SPARKS, INC.
A Mundo Engineering Co. of Los Angeles, Calif.

"Prior to using LUBRIPLATE, we were replacing shaker screen bearings within 60 to 120 days due to lack of or faulty lubrication. Since we started using LUBRIPLATE seven years ago, we have only replaced two shaker screen bearings and these because of natural wear. We now use LUBRIPLATE for general lubrication throughout our plant."

W. T. Ellington, President
Mundo Engineering Co.

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE GREASE AND FLUID TYPE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

LUBRIPLATE is available in grease and fluid densities for every purpose . . . LUBRIPLATE H. D. S. MOTOR OIL meets today's exacting requirements for gasoline and diesel engines.

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

FIELD REPORT

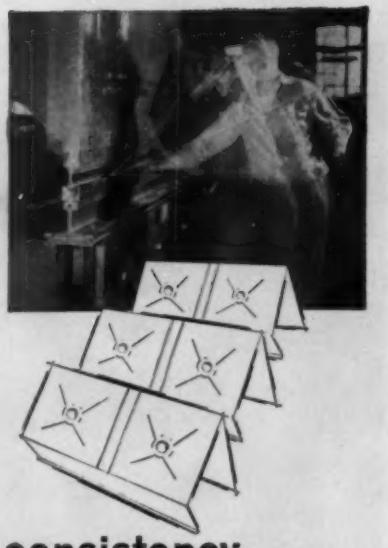
"Dine-O-Stration" watched demonstrations of machine operations over closed circuit television as they ate a smorgasbord luncheon at tables scattered about the showrooms. Afterward they could go from machine to machine to get first hand information on specific details. Guests with technical problems had access to conference rooms where they could go over blueprints, drawings, or actual pieces.

The 300 viewers included officials from John Deere, J I Case, Oliver Corp, International Harvester, Frank Hough Co, and Bendix Aviation as well as from all of the many machine tool companies located in and around Rockford. On hand to discuss technical problems were factory representatives from Wysong & Miles Co, Greensboro, NC; Covel Mfg Co, Benton Harbor, Mich; I O Johannson, Skokie, Ill; Alfred Herbert Ltd, Coventry, England; Burgmaster Corp, Gardena, Calif; Bentley Industrial Corp, New York; Famco Mill, Kenosha, Wis; W A Whitney, Rockford, Ill.

Sterling Die Division . . .

. . . of Pratt & Whitney Co, West Hartford, Conn, will take over the sales and marketing function for P&W's line of thread rolling dies. Formerly sold through the company's sales organization, the change is being made to further improve service to customers and to provide direct personal contact to help solve special problems.

"That two dollar raise you told me to keep quiet about . . . I found out everybody else got a five dollar raise."



consistency...

Consistent, *predictable,* results throughout production processes must begin with the consistent quality of materials. J & L consistent quality stainless steel will give predictable results time after time...order after order.

The service offered by your J & L stainless steel distributor is consistent... and predictable, too. He's as near as your telephone. You'll find that he can further reduce the cost of using stainless steel by providing a complete selection of materials. He can save you the capital investment required to maintain long term inventories. He can provide a wide variety of preproduction services, and reduce your overhead for stocking, handling, accounting and obsolescence.

Your J & L distributor can provide you with the consistent quality stainless steel you need, *as you need it, when you need it.* He can serve you better because *J & L serves him better.* J & L's own staff of technical specialists and metallurgists are at the call of your J & L distributor to give you the technical assistance, even advanced research, you may need.

For better production and better service, call your J & L distributor—call Western Union Operator 25, today.

J&L—a leading producer of stainless steel and precision cold rolled strip steels

J&L
STAINLESS
SHEET • STRIP • BAR • WIRE

CIRCLE 335 READER SERVICE CARD

CIRCLE 336 READER SERVICE CARD

CIRCLE 337 READER SERVICE CARD ►

consistent quality production depends on consistent quality stainless steel
Jones & Laughlin Steel Corporation · STAINLESS and STRIP DIVISION · DETROIT 34

TOTALLY NEW AIR TOOL

Hogs, Blends, Finishes Metal Faster!

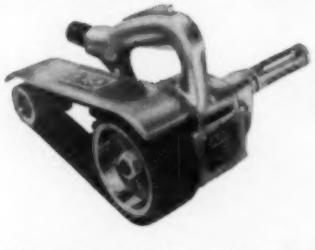
ARO Portable Belt Grinder

You're looking at a new ARO Belt Grinder in action. In this all-new production tool, Aro has combined the backstand idler principle of abrasive grinding with *portability* and *power* to remove metal faster. Live action of the coated abrasive belt running at high speed over slotted, resilient rubber contact wheel sets the abrasive grains "on edge" to give more bite. The metal is actually *sheared* off! Action is smooth and true—no chattering, bumping or bouncing. And you can rough grind and finish in one operation, because the abrasive belt method doesn't leave gouges or swirls in the work. Free belt stropping of corners and radii is easy, too. Beat high grinding costs with new Aro Belt Grinders. Job test one. Ask your Aro Distributor.

Cuts Metal like Butter!

1 Take a rough 6" weld like this. Put a powerful Aro Belt Grinder on the job, and take the grind out of grinding! Full 2 H.P. air motor running at 6000 R.P.M. produces 7000 S.F.P.M. Belt speed—you hog and finish in one operation.

2 Here's the result just 1¾ minutes later, using a 24-grit belt. This is typical of the outstanding performance you can expect from the new portable Aro Belt Grinder—only tool of its kind—unbeatable for grinding performance.



ARO®

AIR TOOLS

AIR HOISTS • AUTOMATION TOOLS
ULTRASONIC CONTROLS

THE ARO EQUIPMENT CORPORATION
Bryan, Ohio

Aro of California, 3141 S. Grand Avenue, Los Angeles 7, California; Aro Equipment of Canada Ltd., Rexdale (Toronto), Ontario
Offices in all Principal Cities

FIELD REPORT

$53 Million Order to Lockheed

Latest Navy contract for additional turboprop P3V-1 anti-submarine warfare planes increases the total value of production work now scheduled on the advanced aircraft to $126.8 million and assures production of the plane at Lockheed's Burbank, Calif, Division through the end of 1962.

Lyon Inc, Detroit . . .

. . . will move production of auto wheel covers from its Detroit plant to a new 200,000 sq-ft building now under construction in Grenada, Miss. Operations are expected to begin in March with a work force of approximately 200.

US Graphite Expands

A $200,000 expansion of facilities for production of Graphitar is underway at US Graphite Co, Saginaw, Mich. The carbon-graphite material is used for parts such as bearings, valves, and bushings and the expansion will enable the company to broaden the size range of its products. As part of the program, it's installing a new Clearing 1000-ton hydraulic press with die cavity of 32 in. in diameter and die fill of 21 in.

Missile Work to Hayes of Ala

Hayes Corp of Birmingham has received some $8 million in missile contract work during the past couple of months. Latest order for $1.1 million is from the George C Marshall Space Flight Center of NASA for installation, fueling, and launching equipment for the Saturn thrust booster.

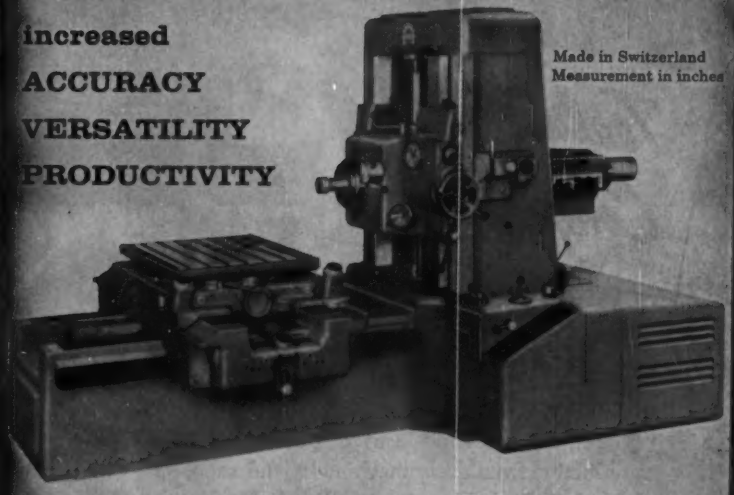
"I've seldom seen a machine use so much oil."

CUT ACCUMULATED ERRORS to a minimum

with the

DIXI 75 horizontal optical jig borer

increased
ACCURACY
VERSATILITY
PRODUCTIVITY



Made in Switzerland
Measurement in inches

- Automatic positioning can be changed instantly to manual operation
- Projected optical setting—direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference
- Simplified controls functionally arranged for greater operating speed and efficiency
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29⅝" cross travel; 23⅝" longitudinal travel; 25⅝" vertical travel
- Hydraulic feeds and infinitely variable spindle speeds
- Rear support optional

MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York.—Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the horizontal optical jig borer.

Demonstrations upon request at our conveniently located demonstration centers.

MBI

M. B. I. EXPORT & IMPORT LTD.
A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N. Y.
Swiss Accuracy plus U.S. Know-how

with **LIPE**

Automatic Machine Loading

● You can meet and beat competition by getting peak production from every machine in your shop – new *and* old. Lipe Automatic Machine Loading delivers at least 90% of the gross geared capacity of any production machine, because stock is fed continuously. Your machines cut stock – not air!

● Lipe AML Bar Feeds automatically feed stock of practically every length, shape and material, in close-tolerance feedouts. Users report production increases of 40% . . . 90% . . . and even 200% per machine, plus labor benefits that are even more important. Workers are freed from back-breaking hand-loading of stock . . . concentrate on quality and machine set-ups. For a free estimate of what Lipe AML can do for your shop, send prints or samples of typical work. Write for full information.

Stop Cutting Air and You Start Cutting Costs

Lipe-ROLLWAY CORPORATION SYRACUSE 1, N.Y.

PIONEERS IN PNEUMATIC BAR-FEEDING

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 VERTICAL HEAD BED TYPE MILL—*Kearney & Trecker Corp, Milwaukee 14, Wis.* 6-page brochure VBT-60 pictures and describes Model 3006 milling machine. Provides plan drawings and specifications, discusses and illustrates machine's design features.

2 ENGINE LATHE—*Sidney Machine Tool Co, Sidney, Ohio.* 12-page bulletin covers new Model 4025 for extra heavy duty. Unit removes metal at rate of 180 cu in. per minute. Complete product information and specifications included.

3 TURRET LATHES—*Jones & Lamson Machine Co, Springfield, Vt.* Illustrated literature provides data on a new ram type turret lathe with multi-speed hydraulic headstock; a saddle type turret lathe with multi-speed headstock; and an entirely new automatic turret lathe featuring complete programming of all machine functions from a single staging panel mounted on the machine.

4 DIE CASTING MACHINES—*Cleveland Automatic Machine Co, 4932 Beech St, Cincinnati 12, Ohio.* 12-page bulletin describes complete line of Cleveland high pressure hydraulic die casting machines, 100, 250, 400, 650, 850, 1000 and 2000-ton models. Details included on such optional features as machine automation and vacuum die casting.

5 THREAD ROLLING MACHINE APPLICATIONS—*Landis Machine Co, Waynesboro, Pa.* 20-page Lanhyrol application booklet LHY-10 illustrates and describes various thread rolling applications which have been and/or are being rolled in the field on the Lanhyrol thread rolling machine.

6 PRESS BRAKES—*Dreis & Krump Manufacturing Co, 7400 S Loomis Blvd, Chicago 36, Ill.* 6-page bulletin SS-60 describes principal construction features and gives general specifications of Chicago straight side type press brakes. Included are a number of large illustrations showing the general application of the large die area on this type of unit.

7 RAM COMPACTING PRESS—*K R Wilson Inc, Arcade, NY.* 8-page bulletin 65 illustrates features of 100-ton opposed ram fully automatic hydraulic unit available in sizes from 20 to 750 tons and

"You know I think my machine is out to get me—"

ANNOUNCING A NEW VANADIUM-ALLOYS DEPARTMENT FOR TOOL AND SPECIAL STEELS IN

cast to shape FORM

A brand new, completely equipped department for Cast-to-Shape tool and special steels—conventional sand casting or precision casting by the Shaw Process or shell molding—varied melting furnace capacity of 30 pounds, 300 pounds, 1000 pounds and 2000 pounds for flexibility in the casting of special analyses with maximum economy and service to our customers.

STANDARD GRADES	FORMEX—a 5% chrome hot work die steel. AIREX—a 5% chrome cold work, air hardening die steel. CROMEX—a 12% chrome cold work die steel.
SPECIAL COMPOSITIONS	Available to customer specifications.
TYPICAL APPLICATIONS	Forming rolls, cams, drop forge trimming dies, forming or blanking dies, molds, draw rings.

For sound castings of closely controlled chemical analysis, and to insure uniformity in machining and heat treating, come to VANADIUM-ALLOYS STEEL COMPANY.

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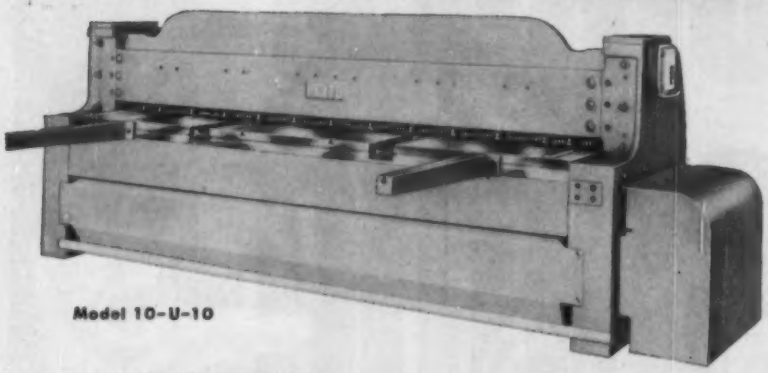
CIRCLE 341 READER SERVICE CARD

FASTER, MORE EFFICIENT SHEET METAL POWER SHEARS — by PEXTO



Model 10-U-10

A COMPLETE LINE . . . . .

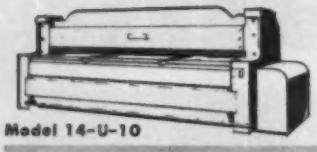
Outstanding in every detail these Precision Power Squaring Shears are engineered and built to shear sheet metal accurately and continuously at full rated capacity.

Frame, bed and crossheads are made from high grade machine tool castings. Positive, self-compensating holddowns; precision gauging and built-in blade clearances provide clean accurate cuts.

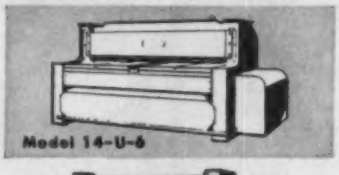
PEXTO Power Shears are designed for long-life maintenance-free operation. Six models efficiently and accurately handle any shearing problems from light gauge through 10 gauge sheet up to ten foot capacities.

SHEAR BLADE SERVICE

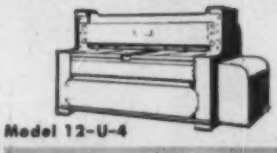
PEXTO four edge blades are precision-made from the finest domestic steel and will give maximum life and accuracy. When sharpening is required, fast factory service is available, enabling you to have new blade performance at all times.



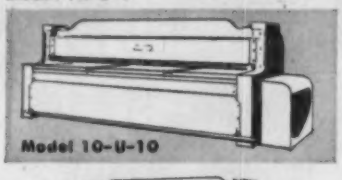
Model 14-U-10



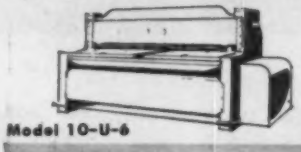
Model 14-U-6



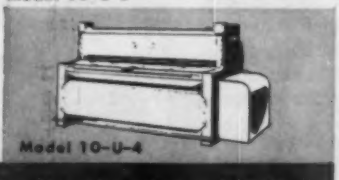
Model 12-U-4



Model 10-U-10



Model 10-U-6



Model 10-U-4

Ask your Distributor or send for Bulletins 57 and 60.

THE PECK, STOW & WILCOX CO. Southington, Conn. U.S.A.

A complete line of machines and tools for Sheet Metal Fabrication

Free Literature

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designed for refractory materials, abrasives, and powdered metals. Specifications detailed.

8 SINGLE CRANK PRESSES—*Federal Machine & Welder Co, Warren, Ohio.* 8-page bulletin 52181 pictures and describes the WARCO line of single action straight side single crank presses in capacities from 60 to 400 tons.

9 GEAR SHAPER; HOBBING MACHINE—*Fellows Gear Shaper Co, Springfield, Vt.* Two illustrated brochures are available—one covers the Fellows 3-in. fine-pitch gear shaper, the other describes the Fellows-Pfauter P400 high-speed hobbing machine.

10 MULTI - PURPOSE MACHINE TOOLS—*Frauenthal Division, Kayden Engineering Corp, Muskegon, Mich.* 8-page bulletin 560 describes vertical machines for precision standard and contour grinding, turning, boring, and other machining. Includes four standard series and production or specialized custom machines to meet individual requirements with swing of up to 178 in. or more. Data is provided on tracer or numerical control for these machines, standard features, optional equipment, and custom engineering services.

11 MICROSTONING—*Taft-Peirce Mfg Co, Woonsocket, RI.* 16-page catalog 319 provides detailed information on all Taft-Peirce/Supfina microstoning equipment. Explains advantages of the new process in which special abrading or polishing stones are oscillated against moving workpieces to generate controlled micro-inch finishes while correcting out-of-roundness and removing surface imperfections left by prior machining. Machines, attachments, and accessories covered.

12 SWAGING—*Fenn Manufacturing Co, Fenn Rd, Newington, Conn.* 16-page booklet contains basic information on the subject. Includes sections on what it is; what can be swaged; metallurgical effects of swaging; selecting equipment; tooling and feeding swagers.

TOOLS AND ACCESSORIES

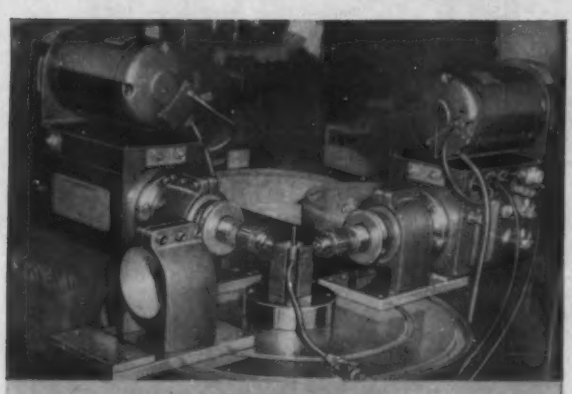
13 OPTICAL COMPARATORS AND MEASURING MACHINES — *Jones & Lamson Machine Co, Springfield, Vt.* Individual brochures on the basic models of these units include: Model FC-30ER gives details on the latest design of this extended range 30-in. screen comparator;

"If you don't think this company could stand a little modernization, wait'll you get a look at the company plane."

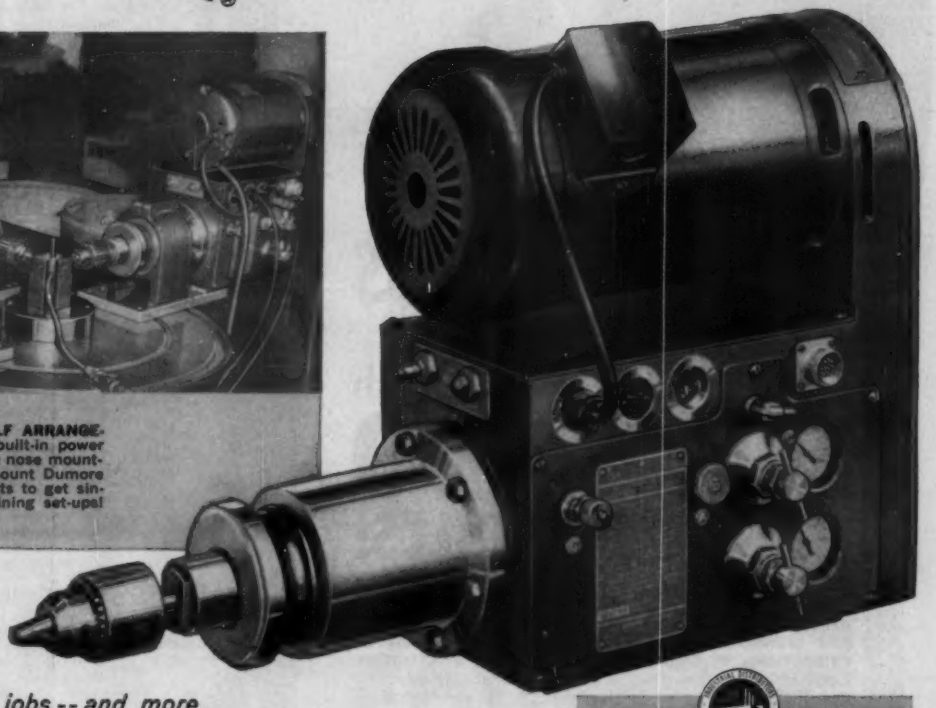
versatile "building blocks" for...

simple, cost-cutting set-ups

DUMORE® AUTOMATIC DRILLING UNITS



EASY, DO-IT-YOURSELF ARRANGEMENTS . . . completely built-in power and controls and simple nose mounting brackets let you mount Dumore Drilling or Tapping Units to get single or multi-hole machining set-ups!



do all these jobs -- and more

TAP • DRILL • REAM • CHAMFER
SPOT-FACE • CENTER • DE-BURR

Low first cost. Low operating cost. You benefit on high or low production runs. Simple design, unique mounting, and self-contained adjustable feed and speed controls permit *quick* changeover from job to job—eliminates expensive idleness of high-cost special machines.

Completely automatic—eliminates operator slowdowns and errors—minimizing scrap loss, tool breakage while maintaining *constant* production rates. Even unskilled labor can learn to operate in minutes. Precision engineered with famous Dumore quality and workmanship, to give trouble-free performance over millions of cycles. Pneumatic feed uses almost no air . . . a real cost-cutting feature!

Want more details? . . . *Write Us*

SEE YOUR LOCAL DUMORE INDUSTRIAL SUPPLY DISTRIBUTOR, NOW

. . . for a demonstration at your own shop, if you like. He'll be glad to show you sample set-ups, too. 3 models to choose from, priced from $565.75 FOB Racine, complete with all components including motor, ready to operate. Ask him to show you the wide range of accessories available.

YOU CAN DO MORE WITH DUMORE® PORTABLE PRECISION METALWORKING TOOLS

THE DUMORE COMPANY • 1329 17th St., Racine, Wisconsin

VERSA MIL • DRILL-N-TAP UNITS • DRILLING UNITS • DRILL HEADS
MICRO-DRILLS • DRILL GRINDERS • PRECISION GRINDERS
HAND GRINDERS • FLEX-SHAFT TOOLS • QUILLS AND ACCESSORIES

HOLES
CO$T LE$$
when drilled with
ELDORADO*
GUN DRILLS:

Eldorado Gun Drills are your best guarantee for excellent surface finish and top quality performance in gun drilling flawless, straight, round, accurately located holes at high speeds in one single operation. Each Eldorado Gun Drill is precision made to exacting specifications by gun drill specialists. Gun drill making is our business, our only business.

With hole after hole, in drilling steel, iron, aluminum or other alloys, at speeds and feeds impossible with other types of drills, Eldorado drills cut costs in time, labor, tools, materials and maintenance.

There's an Eldorado Gun Drill for your job! Immediate delivery from factory stock. We invite you to talk over your 'hole' problem with us at no obligation.

Send for NEW LITERATURE on Gun Drills and Gun Reamers.

ORDER STOCK SIZES FOR IMMEDIATE SHIPMENT. TO SPECIFICATIONS, ON NORMAL DELIVERY.

MADE TO YOUR SPECIFICATIONS:		AVAILABLE FROM STOCK:	
Sizes	.1250" to 2" dia.	⅛" to ½" dia. in 64ths	½" to ¾" dia. in 32nds
OA Lengths	4" to 120" with dia. limits	10", 16", 22", 36"	16", 22", 36"
Drivers	Std. or to fit you need	.750" dia. x 2¾" long	1" dia. x 2¾" long
Tips	Carbide	Carbide	Carbide
Now, order from stock, or send in your specifications for a prompt quotation.			

Specializing 100% in Gun Drills and Related Tools.

ELDORADO TOOL & mfg. corp.
340 BOSTON POST ROAD • MILFORD, CONN.
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Free Literature

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Model FC-30 provides information on latest design of this standard model 30-in. screen comparator; Model FC-14 and TC-14 includes data on the most complete 14-in. screen comparators in the J&L line; Model TC-10 covers the new 10-in. screen, economy sized model optical comparator and measuring machine; Model PC-14A describes newest addition to the line, a 14-in. screen comparator.

14 GEAR INSPECTION EQUIPMENT —*National Broach & Machine Co, 5600 St Jean Ave, Detroit 13, Mich.* 4-page bulletin C60-8 describes new Red Ring gear inspection machines including a precision involute profile checking machine designed especially for checking gear shaving cutters.

15 WALL CHART OF CONVERSION FACTORS—*Precision Equipment Co, 4411E Ravenswood Ave, Chicago 40, Ill.* 8½ x 11-in. chart contains many conversions that are difficult to locate in reference manuals.

16 TAPS—*Beloit Tool Corp, Regal Division, 12013 Milwaukee Rd, Beloit, Wis.* Catalog contains price lists for special and standard taps plus technical information including tap terminology; recommendations for fraction size taps and for numbered size taps; dimension tables; dimensions of special fine pitch hand taps and machine screw taps; table of tap and drill rpm; and table of decimal equivalents.

17 END MILLS—*Putnam Tool Co, 2935 Charlevoix Ave, Detroit 7, Mich.* 124-page catalog 60 lists over 1800 standard sizes and types. Each end mill is illustrated, described, and pertinent dimensional data is provided. In addition to standard end mills, the publication contains listings and information on other cutting tools such as reamers, counterbores, and special purpose tools.

18 TACHOMETERS — *Jones Motrola Corp, 432 Fairfield Ave, Stamford, Conn.* 12-page catalog 62 contains photos, drawings, and descriptions of 19 distinct types of Jones tachometers together with illustrations of various types of flexible shafts and drives and drawings of drive arrangements.

"Boss is certainly getting back at us for that last strike!"

THE MAN FROM MUELLER BRASS CO.

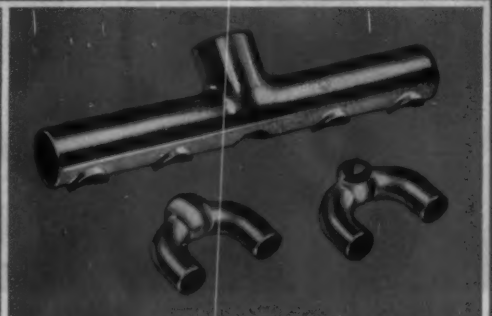
REPRESENTS ONE DEPENDABLE SOURCE FOR PARTS FABRICATED TO YOUR SPECIFICATIONS FROM COPPER, BRASS, ALUMINUM AND PLASTICS

In today's market, the Man From Mueller Brass Co. can help you save both time and money. Mueller Brass Co. offers a variety of production methods and you get an unbiased opinion on the most practical and economical way to make your specific part . . . hence you save time in planning and engineering, and money in production. Consult the Man From Mueller Brass Co. . . . you'll find he's a good man to know . . . and Mueller Brass Co. a dependable source for fabricated parts.

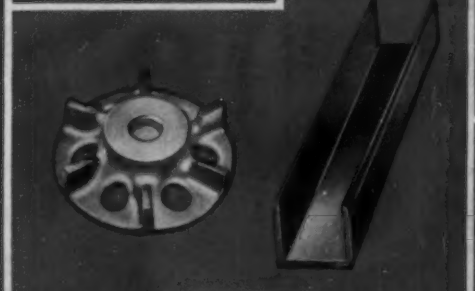
Write today for information on any of the many quality products shown here.

FORGINGS

POWDERED METAL PRODUCTS



FORMED COPPER TUBE



CUSTOM EXTRUDED
PLASTIC SHAPES AND INJECTION MOLDINGS

SCREW MACHINE
PRODUCTS

COLD-PREST
IMPACT
EXTRUSIONS

MUELLER BRASS CO.

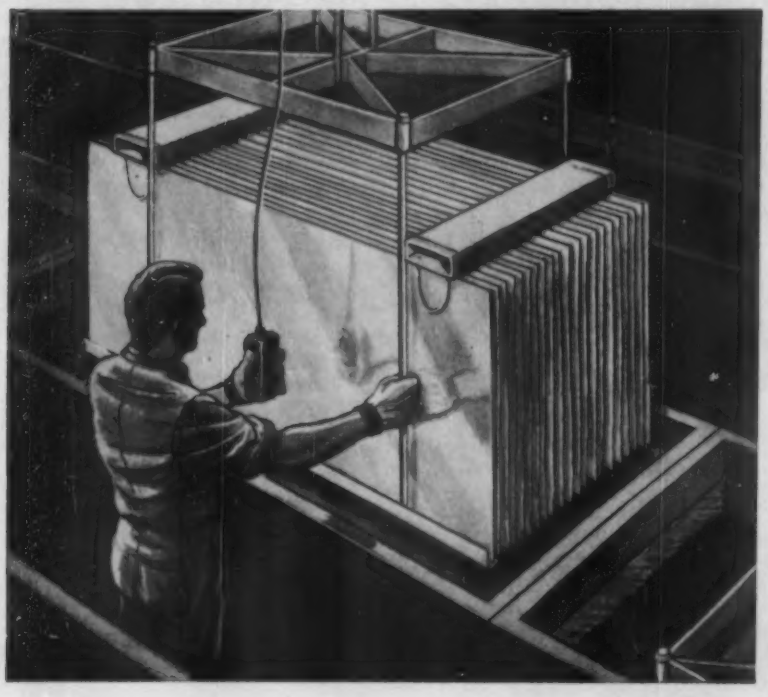
MUELLER BRASS CO., PORT HURON 24, MICHIGAN

317

For safe, sure tank cleaning of aluminum

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



Stencil inks, shop soils disappear fast in Oakite Aluminum Cleaner 164

Here is a heavy duty yet perfectly safe alkaline cleaner for all aluminum alloys. Parts immersed in a tank of Oakite 164 emerge free of even the most tenacious identifying inks, greases and other shop soils. There's no etching at all.

Air agitation of this efficient, non-foaming solution speeds cleaning action, although Oakite 164 works efficiently even without this aid.

To meet *any* aluminum cleaning requirement—ask Oakite. There's a *whole line* available—solvent as well as alkaline. Whichever is recommended, you can be certain of service as well as safety. Send for Bulletin B-6395. Oakite Products, Inc., 45B Rector Street, New York 6, N. Y.

It PAYS to ask Oakite

OAKITE

over 50 Est. 1909 SCIENCE years' leadership in industrial cleaning

Free Literature

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HEAT TREATING AND WELDING

19 FURNACES—*Sunbeam Equipment Corp, 190 Mercer St, Meadville, Pa.* 4-page brochure provides brief, illustrated descriptions of a box recirculating furnace, an automatic shuffle hearth unit, a pit recirculating model, and the automatic Casemaster furnace.

20 CARBON DIOXIDE WELDING—*Pure Carbonic Co, Division of Air Reduction Co, 150 E 42 St, New York 17, NY.* 8-page brochure covers the characteristics of CO_2 gas-shielded metal-arc welding of mild steel and low alloy steel; advantages of CO_2 in welding; and the various welding processes employing carbon dioxide as a shielding gas. Applications illustrated.

21 FIXTURES FOR HEAT TREAT FURNACES—*Wiretex Manufacturing Co, 40 Mason St, Bridgeport, Conn.* Catalog sheet illustrates parts-holding fixtures for four principal types of heat treating furnaces. Includes 15 different muffles, retorts, trays, and baskets for use with bell, salt bath, pusher, and pit type models.

PLANT SERVICE EQUIPMENT

22 INDUSTRIAL POWER SYSTEMS—*General Electric Co, Schenectady 5, NY.* 48-page illustrated publication GEA-7139, "Better Power for Production," outlines principles of planning industrial power distribution systems for safety, reliability, and economy while retaining flexibility and provisions for future expansion. Chapters include choosing voltages; short circuit calculations; protective relaying; selection of unit substations; power factor corrections; and grounding.

23 FINISHING EQUIPMENT—*J Holland & Sons Inc, 477 Keap St, Brooklyn 11, NY.* 146-page illustrated catalog describes complete line of electro-plating, polishing, and spray painting equipment and supplies. Also provides information on company's drying ovens, tumbling barrels, rectifiers, control panels, and a variety of steel and wood tanks.

24 CENTRIFUGAL PUMPS—*Aurora Pump Division, New York Air Brake Co, Aurora, Ill.* Bulletin pictures and describes line of vertical single stage split case units for handling high capacities at medium to high heads and continuous operation. Capacities range to 6000 gpm and heads to 380 ft.

"In your memo you said, and I quote, 'There will be no more smoking IN the drafting room' !"

LOOK at these LOW HOURLY "WAGE RATES"

Here are hourly "wage rates" for just 16 of many DoALL machine tools. It shows you the extremely low cost of putting their great earning power to work in your plant without capital expenditure. Their high productive capacity can earn as much as ten times their "wage rate." Put DoALL machine tools on your payroll to reduce manufacturing costs. There is a best machine for every job. Use convenient coupon below.

1 BAND FILER — 16¢

Accurate high-speed filing work

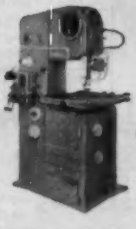
2 UTILITY MACHINE — 26¢

Light-duty all-purpose manual operation

3 CONTOUR-MATIC* — $1.76

Fixturable table power feed uses HSS saw bands

4 CONTOUR MACHINE — 51¢



For contour sawing, filing polishing

5 POWER SAW — 41¢

For hand-operated cut-off work

6 LAPPING MACHINE — 71¢

Ultraprecision dimension finishing

7 ZEPHYR MACHINE — 89¢

High-speed and friction sawing

8 POWER SAW — Automatic heavy-duty cut-off work — $1.44

9 SURFACE GRINDER — 33¢

Precision manual operation

10 SURFACE GRINDER — $1.28

Production precision automatic operation

11 BAND MILL — $5.13

For slabbing shanking refacing

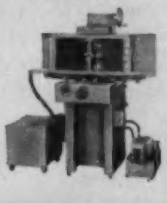
12 ANGLE POWER SAW — $1.65

Automatic angular cuts up to 45°

13 I/D MICRO-SLICER — $1.80

Automatic precision slicing semiconductors

14 MICROTOM-ATIC* — 61¢



Manual precision slicing and dicing

15 PAN-ARM* SAW — $7.76

Contour cutting huge parts

*Reg. T.M.—The DoALL Company

16 CONTINENTAL PRODUCTION SAW — $2.40

For continuous heavy-duty cut-off work T. carbide saw bands

MAIL THIS COUPON TODAY!

THE DoALL COMPANY Des Plaines, Ill. B-65

We want more information on the machines checked HERE:

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Company_____

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City_____ Zone____ State_____

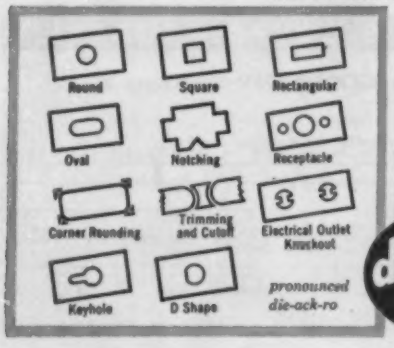
ACCURACY ASSURED

WITH DI-ACRO PRECISION PUNCHES AND DIES

Immediate Delivery from factory stock

Accurate hole location is easily achieved with Di-Acro Precision Punch and Die sets because the centering point on the punch is ground concentric to the cutting edges, there is no "slop" even when several holes are punched in a blank. Hole sizes are accurate due both to the high degree of concentricity of the punch and die set and the choice of clearance which allows you to obtain clean, burr free holes no matter what material thickness is to be perforated. All Di-Acro punches and dies are precision made of high quality tool steel.

For multiple hole punching ask about the new Di-Acro Adjustable Punch and Die Sets.



Over 500 standard sizes of Di-Acro Precision Punches and Dies in 12 standard styles are stocked. Punch Adapters and Die Holders are available to fit all styles of punch presses.

For extra convenience and savings order Di-Acro Punch Paks—fitted steel chests containing 24 and 30 sets of punches and dies.

Consult phone book Yellow Pages under Machinery—Machine Tools for your Di-Acro distributor or write for catalog and prices.

di-acro PRECISION METALWORKING EQUIPMENT

O'NEIL-IRWIN MFG. CO.
405 Eighth Avenue
Lake City, Minnesota

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

25 SELECTIVE PLATING—*Selectrons Ltd, 320 Fifth Ave, New York 1, NY.* 8-page bulletin I lists varied engineering applications of a new high-speed process called Selectron that uses a special rectifier, metallo-organic solutions, and a variety of styluses to achieve dense deposits of almost any metal on any basis metal. Plating may be confined to as small or large an area as required, generally eliminating large tanks.

26 VACUUM DIFFUSION PUMPS — *NRC Equipment Corp, 160 Charlemont St, Newton 61, Mass.* 12-page catalog contains basic descriptive information on diffusion and booster pumps, shows speed curves for small, medium, and large models ranging from 1 to 32-in. sizes, and includes both tabular specifications and outline drawings for each pump.

27 STRAPPING METHODS AND TOOLS—*Signode Steel Strapping Co, 2600 N Western Ave, Chicago 47, Ill.* 40-page pocket-size booklet is the 20th edition of the basic reference guide "Better Ways to Package, Unitize, and Ship." New material includes descriptions of Signode's compression strapping and jib crane systems; heavy-duty model TH feed wheel tensioner; the air-powered RCNS sealer; and new dispensers and strap cutters.

PARTS AND MATERIALS

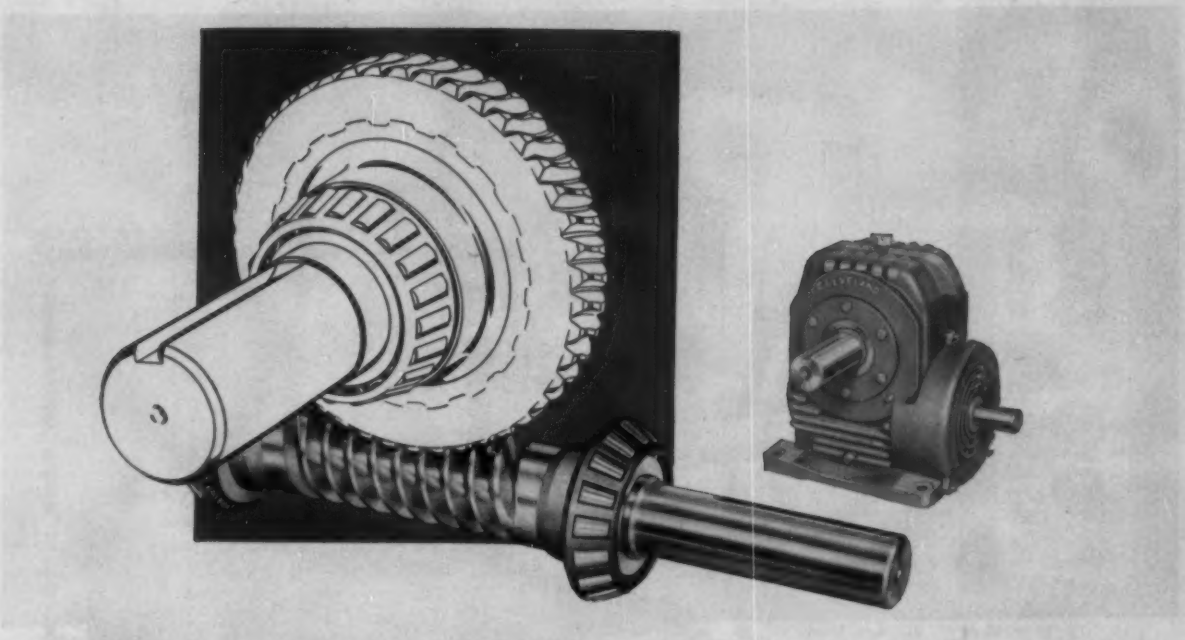
● TOOL STEEL—*Darwin & Milner Inc, 2222 Lakeside Ave, Cleveland 14, Ohio.* 144-page catalog of complete line features a simple selector for the 24 varieties supplied by the company. Describes several new types offered for the first time. Gives composition and properties and suggested applications for each steel, followed by detailed instructions for heat treatment. Describes many tool steel specialties including castings, forgings, drill rod, flat-ground stock, and toolbits. Request direct on company letterhead.

28 SQUIRREL CAGE INDUCTION MOTORS—*Fairbanks, Morse & Co, Electrical Division, Freeport, Ill.* 8-page bulletin 1150 describes electrical and mechanical features of these newly re-rated, guarded dripproof motors in NEMA standard dimensioned frames 182 through 445U.

29 DIE STEEL—*Heppenstall Co, 4620 Hatfield St, Pittsburgh 1, Pa.* Data Sheet 3 gives characteristics and typical applications of Prestem and Presneal, a low carbon, high molybdenum, high nickel precipitation hardening die steel developed especially for hot working of ferrous and non-ferrous metals in presses and upsetting machines. Data sheet indicates hardness ranges and gives instructions for heating for hardening, quenching, and aging.

(Continued on p 249)

"How's old 'safety is for the birds' this morning?"



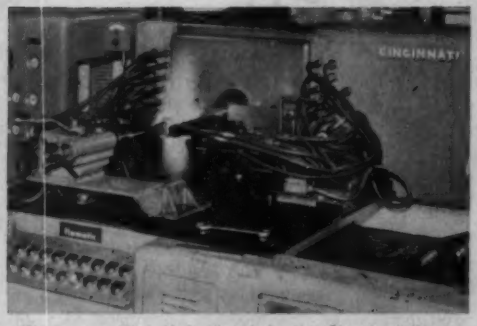
Flamatic-hardened worms help give Cleveland Speed Reducers their longer service life . . .

On all Cleveland Speed Reducers, alloy steel worms are cut integral with the shaft and accurately ground to a high surface finish on both thread flanks. Shaft extension diameter is especially large to permit increased overhung load capacity. Heat treatment is by a special "Flamatic" process—exclusive with Cleveland-made worms. This provides a high degree of hardness throughout the entire thread thickness and well below the worm's root diameter—(See etched worm cross-section).

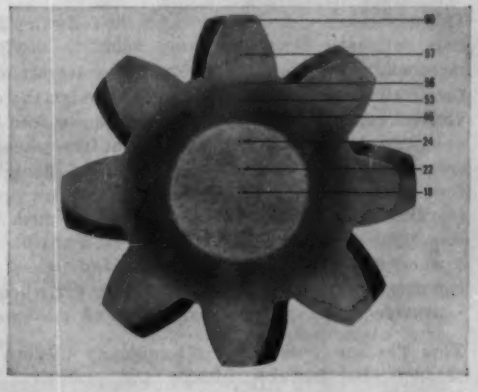
This new worm hardness pattern gives maximum thread strength and resistance to wear without sacrificing the advantage of a medium-hard tough core. Furthermore, the pattern is carried out in the worm shaft extension past the oil seal wearing surface to prevent the shaft being worn and damaged by its oil seal.

Mated with Cleveland's high density centrifugally cast bronze gears, the result is increased wear resistance—much longer trouble-free service life.

Why not write today for your free copy of Bulletin No. 405 showing the latest developments in the Cleveland Worm Gear Line. Or, better yet, contact your nearest Cleveland Representative and get the complete facts.



Worms are Flamatic-hardened in the Cleveland Plant (above) to give them the typical Rockwell "C" hardness pattern as shown in the etched cross-section (below).



CLEVELAND
Worm Gear
Speed Reducers

Cleveland Worm & Gear Division
Eaton Manufacturing Company
3254 East 80th Street • Cleveland 4, Ohio

Thompson's exclusive "CYBERMATIC PENDANT CONTROL" completely eliminates the elevating hand wheel

All vertical movement of the wheel head, both automatic and manual, on this modern Thompson 36 x 48 x 72 Type CX Plunge-Matic Grinder is accomplished effortlessly by dials on the Cybermatic Pendant Control.

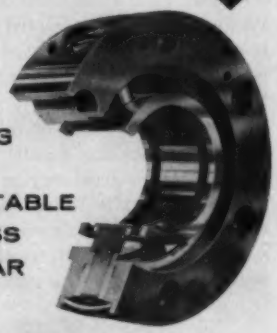
This new pendant control performs the following functions: **Sets automatic down feed from .0002" to .006" in .0002" increments—sets the total amount of automatic down feed for stock removal from 0 to 1 inch through the entire 48" vertical capacity—controls automatic down feed increment (as pre-selected) at each reversal of the wheel head on cross feed or at each table reversal on straight plunge feed — controls a 20" per minute rapid traverse to the elevation of the wheel head—provides a push button to re-set the down feed range at operator's will — pre-sets a wheel dressing increment for automatic wheel trueing—compensates manually or automatically for wheel dressing —provides a master stop button for all movement.**

This Thompson machine is completely modern in every respect. Its features include the exclusive Thompson Hydra-Cool Hydraulic System with dual packless cylinders providing automatic cushioning. A separate automatic lubrication system for all sliding way bearings and tape bed way covers are standard equipment.

This modern Thompson grinder is both high powered and extremely accurate.

Further specifications will be furnished upon request.

PRE-LOADED
SELF-ADJUSTING
COLD RUNNING
ROTATIONALLY STABLE
VIBRATIONLESS
FREE FROM WEAR



Thompson has taken another important step toward the ultimate in accuracy and precision by obtaining the exclusive use of the world famous MALCUS BLOCK BEARINGS for their wheel head spindles. The notable advantages of these bearings are listed above.

Thompson SURFACE GRINDERS

THE THOMPSON GRINDER COMPANY • SPRINGFIELD, OHIO

"Keep Thompson in mind for that daily grind"

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

30 FLEXIBLE CUSHION COUPLINGS —*Dodge Manufacturing Corp, Mishawaka, Ind.* 20-page bulletin 901 describes two new types of Para-flex couplings, one for high speed, high torque applications and another for attachment to flywheels of internal combustion engines. High Speed and Flywheel couplings are offered in sizes to deliver up to 47 hp per 100 rpm, with bushings to fit shafts up to 4 in. diameter. Engineering data, photos, dimension drawings, and selection tables included.

31 PRECISION SWITCHES—*Unimax Switch Division, W L Maxson Corp, Ives Rd, Wallingford, Conn.* 32-page catalog 10-1 contains detailed information on the expanded line of snap-acting switches. Pictorial index shows location of dimension drawings, descriptions, force and movement specifications, electrical ratings, and a picture of each switch.

32 LOCK NUTS—*Palnut Co, 81-L Glen Rd, Mountainside, NJ.* 24-page catalog 592-A covers complete line of spring tempered steel lock nuts including regular hex, integral washer, acorn, wing, and adjusting nut types. Gives details of design and locking principle, advantages, typical applications, specifications, load ratings, materials, and finishes.

33 SPRINGS—*Sandvik Steel Inc, Spring Dept, 1702 Nevins Rd, Fair Lawn, NJ.* 12-page booklet describes line of flat spiral power springs including two variations of a new spring design. Illustrates and discusses four spring types—spiral, cross curved, stainless, and integral band with and without bridle. Includes reference data on spring nomenclature, various types of ends and centers, and lists data required when ordering.

34 ADHESIVES SELECTOR CHART —*Hysol Corp, Adhesives Dept, Olean, NY.* Chart (bulletin A-100) shows the outstanding properties of key Hysol adhesives and hardeners, their tensile shear strengths at different temperatures, and in several fuels. Operating temperature range, impact, coefficient of thermal expansion, and other criteria are indicated.

35 HEAVY STUD CAM FOLLOWERS —*McGill Manufacturing Co, Bearing Division, Valparaiso, Ind.* Illustrated bulletin lists both the CFH and SCFH (sealed) series of Camerol cam followers. Drawings, special features, and mounting instructions given for both. Dimensional data, tables for determining speed factors, life factors, proper stud size, and recommended clamping torques included.

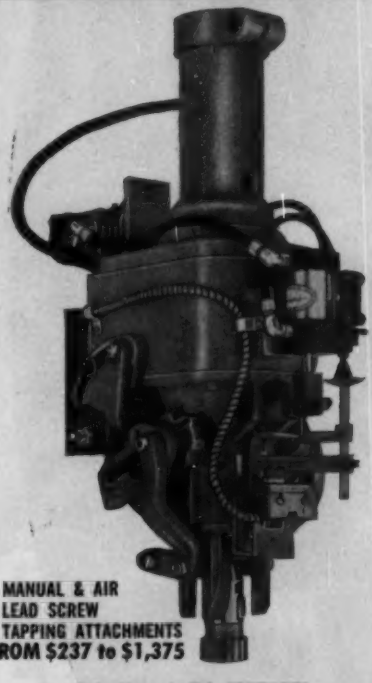
"A little proper personnel relations pitch never hurt anybody, our foremen have come to feel . . ."

HOW TO TAP UP TO 5,000* SMALL PARTS PER HOUR WITH PRECISION AND AT LOW COST

WITH THE JARVIS AIR-OPERATED AUTOMATIC

LEADSKRU-MATIC

CHANGE PITCH IN SECONDS WITHOUT CHANGING LEAD SCREW



MANUAL & AIR LEAD SCREW TAPPING ATTACHMENTS FROM $237 to $1,375

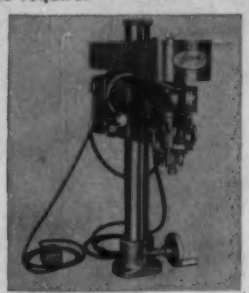
VOLUME PRODUCTION WITH PRECISION
This Air-Operated, Automatic Lead Screw Tapping Attachment converts your drill press into an extremely accurate tapping machine capable of volume production.

***5,000 SMALL PARTS PER HOUR**
Using the **LEADSKRU-MATIC** as the basic machine, one of our customers built a small parts tapping unit comprising table, hopper feeds, holding fixtures, controls, etc., which taps up to 5,000 nut blanks per hour . . . **AUTOMATICALLY. And at a lower cost** than less versatile tapping machinery!

SHORT OR LONG RUN VERSATILITY
Besides the deluxe, air-operated, adjustable pitch model shown at left, you have, according to your requirements, a choice of electrically driven, manually operated adjustable pitch tapping attachments, or conventional single pitch units. No need to pay for extra features or parts that your jobs do not require.

LEADSKRU-MATIC FEATURES WORTH YOUR INVESTIGATION

1. Adjustable Pitch — Change pitch in seconds without changing lead screw.
2. Exact thread depth control.
3. Forward and Reverse controlled.
4. Cuts tap breakage—won't rip threads.
5. 22 separate Pitch Adjustments with 2 models.
6. Longer tap life — Uniform threads.
7. Gives both speed and precision.
8. Accurate lead at all settings.
9. Adjustable stop settings for various depths.
10. Constant production with unskilled operators.
11. Fits any Drill Press.
12. Available with fixed or multiple spindle heads.



JARVIS AUTOMATIC, AIR-OPERATED LEAD SCREW TAPPER ADAPTABLE TO DRILL PRESS TABLE
Where complete automation is not desired, machine is equipped with standard hand-operated model lead screw units.

Jarvis CORPORATION
Middletown, Connecticut

SEND COUPON FOR PROMPT DETAILS

To: Jarvis Corporation 26 Pease Ave., Middletown, Connecticut
☐ Have Rep. call ☐ Send Lead Screw Cat.
Name ..... Title .....
Company .....
Street .....
City & State .....

How efficient are Joydex cutters? We quote from a recent performance report: "Facing and rough milling a chrome-moly vanadium casting (Brinell 250) to a depth of ⅞" at cutting speed of 200 SFPM, the 12" dia. Joydex milled approximately 300 cu. in. per blade edge. Performance was beautiful."

Send for "Joydex" Catalog.

LOVEJOY TOOL COMPANY, INC.
Springfield, Vermont, U.S.A.

NAMES IN THE NEWS

Joy Manufacturing Co, Pittsburgh, has appointed **C A Patten** works manager of its New Philadelphia, Ohio, plant. **Jack K Adams,** chief industrial engineer for the company, replaces Mr Patten as manufacturing manager of the Franklin, Pa, plants.

SKF Industries, Philadelphia, has appointed **Calvin C Weigold** plant manager of Reed Instrument Bearing Co, Los Angeles division. Mr Weigold joined SKF in 1958 as a senior staff industrial engineer.

Ampex Data Products Co, Redwood City, Calif, has appointed **Dennis D Willard** manager of the Advanced Computer Laboratory. Mr Willard was previously manager of advanced technical planning of the Advanced Systems Development Division at IBM, San Jose, Calif.

Thermal Dynamics Corp, Lebanon, NH, has appointed **George A Klasson** supervisor of the Plasma Flame Cutter Department. He was formerly sales manager for Okiva Inc, Cincinnati welding equipment distributors.

Grove Valve & Regulator Co, Oakland, Calif, has named **George E Doty** vice president and general sales manager in charge of all sales activities. **B J Hancock,** formerly eastern regional sales manager, succeeds Mr Doty as vice president, sales; he will be in charge of all field sales.

Electric Autolite Co, Toledo, has named **Earl R Fiene** director of automotive original equipment sales. Mr Fiene has most recently been associated with the Stewart-Warner Corp where he was manager of OEM sales for the Alemite-Instrument Division.

Hughes Aircraft, Culver City, Calif, has named **Donald D Mallory** manager of product operations for the components division. He has been associated with the company since 1957 in various engineering and development positions.

Hendrick Manufacturing Co, Carbondale, Pa, manufacturer of perforated metal, screens, grilles, and flooring, has named **Benjamin G Dann Jr,** director of production.

Black & Decker Manufacturing Co has appointed **John L. Turnbaugh** manager of the Towson, Md, plant. Formerly tool engineering manager, he replaces **Karl B Salanda** who was resigned.

Alemite Accumite® Centralized Lubrication System avoids costly breakdowns, work-stoppage. Automatic positive lubrication protects all machines!

The Alemite Accumite® Centralized Lubrication System comes complete with pump, metering valves and controls. Meters exact amount of lubricant to all bearings whenever system is operated by air, vacuum or manually at any predetermined frequency.

There's no need for a lubrication shutdown. No chance of work spoilage or bearing failure due to over lubrication. The Alemite Accumite System accurately meters .003, .006 or .009 cu. in. shots of oil or grease automatically. Is available with adjustable fittings for applications requiring measured metering from .003 cu. in. to zero. "Snap-On" and "Screw-In" type valves make for complete flexibility in converting existing systems to automatic operation.

You are assured economical, trouble-free operation of equipment. All bearings are sealed against dirt, grit and water. You are able to eliminate the dangers of neglect because all bearings receive proper lubricant in one, automatic, safe operation!

For complete details on Alemite Accumite® Centralized Lubrication Systems for large or small, stationary and mobile equipment (Canning and Labeling Machines • Tractor Trailers and Lift Trucks • Farm Implements • Machine Tools • Textile Machines • Any Machine or Vehicle with Moving Parts) write for your *FREE* Alemite Accumite Catalog . . . today!

Symbol of SW Excellence

ALEMITE DIVISION
STEWART-WARNER CORPORATION
1850 Diversey Parkway, Chicago, Illinois

WHICH WAY?

There are many ways to weld, but you want the one that *best* fits your needs. Your choice is determined by metals, thicknesses, designs, joints...and your fabricating objectives—economy, quality, speed, strength, appearance, precision. Which welding process should you use? Tig? Mig? CO_2? Spot welding? Manual, semi-, or fully-automatic? Would a cutting process simplify production? Correct answers to these questions require experience with the major arc welding and cutting processes—from submerged arc to plasma arc—introduced during the past 25 years. LINDE has *all* of these processes. No other company does. In fact, LINDE *introduced* almost all of them...and *improved* the rest. Consequently, LINDE has far more experience with tungsten-arc cutting, inert-gas welding, and continuously-fed electrode welding than any other company in the world. In many cases, these processes are ideal. In some, they are even a necessity. Because we have all of them, we recommend only the one that *best* fits your needs. When making your choice, bear in mind that a recommendation from an equipment manufacturer is apt to be *only as accurate as the completeness of his line.*

LINDE COMPANY

Division of Union Carbide Corporation
270 Park Avenue, New York 17, N. Y.

UNION CARBIDE

"Linde" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

NAMES IN THE NEWS

Chemical Micro Milling Co, a division of the Beck Engraving Co of Philadelphia, has named **William A Strauss Jr** general manager. Mr Strauss was formerly associated with Beemer Engineering Co.

P R Mallory Co, Indianapolis, has named **Dr Donald G Wilson** vice president, research. Before joining the company Dr Wilson was an assistant vice president of the Stromberg-Carlson Division of General Dynamics Corp.

Clearing Division of US Industries has appointed **Anthony L Barbaro** director of purchases.

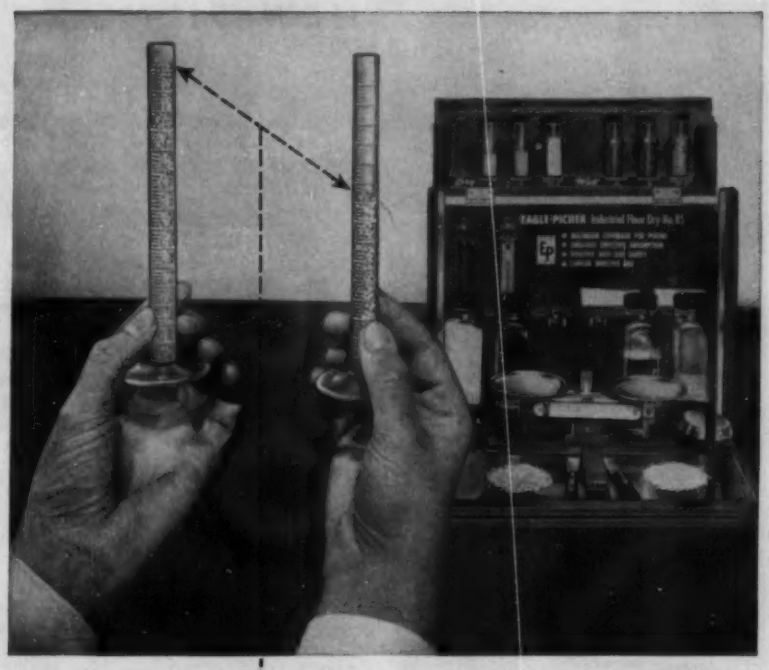
Ray H Morris & Co, West Hartford, Conn, machine service specialist, has announced that **George T Morris** has joined the organization as vice president. Mr Morris has been a sales and field engineer for machine tool manufacturers and distributors specializing particularly in production equipment in the turret lathe and chucking machine fields.

Allis-Chalmers has named **H T Larmore** to the newly created post of general products manager of the Construction Machinery Division. He was formerly sales manager for crawler tractors and motor graders.

American Society for Testing Materials has elected **Thomas A Marshall Jr** executive secretary. Mr Marshall is currently senior assistant secretary of the American Society of Mechanical Engineers.

J Bishop & Co Platinum Works, Malvern, Pa, has named **William C Stewart** manager of the Mechanical Division. Before joining the company Mr Stewart was senior staff industrial engineer with SKF Industries.

AC Spark Plug, the electronics division of General Motors, has made three major plant promotions in its Milwaukee operations. **Harold W Mueller,** superintendent of test equipment and manufacturing, is now general superintendent of test equipment manufacturing and engineering. **James H Peterson,** superintendent of the toolroom, becomes assistant to the director of production engineering. **Malcolm T Stamper,** chief manufacturing development engineer, has been made general superintendent of toolrooms and manufacturing development.



There's a BIG difference in floor absorbents

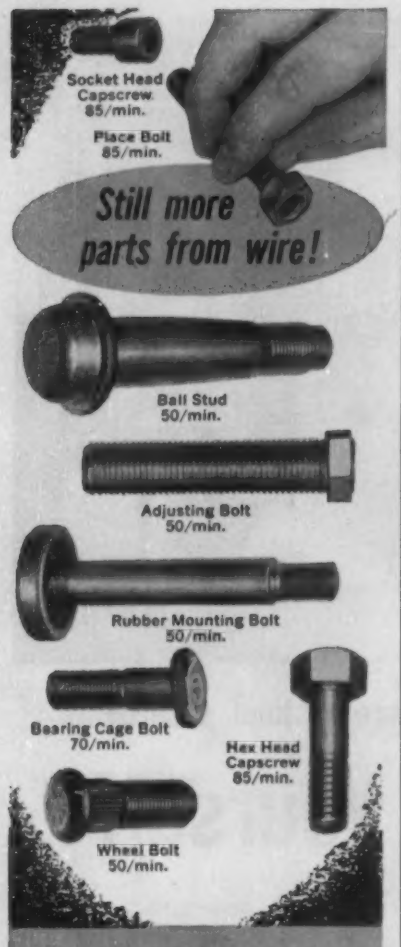
TEST IT Yourself!

IN YOUR OWN OFFICE, make this simple 15-minute test. Compare Eagle-Picher Industrial Floor-Dry to any other floor absorbent.

HERE'S WHAT YOU'LL PROVE TO YOURSELF about safe, skid-proof Eagle-Picher Floor-Dry: It's extremely insoluble, absorbs more oil and water. It goes further, provides much greater coverage. It reflects more light, brightens the work area. It's non-combustible, has no chemical reaction. It lasts longer, saves you money!

Since 1843 EAGLE EP PICHER

WRITE TODAY. Our Eagle-Picher representative will bring the portable laboratory to your office where you may make this test yourself. The Eagle-Picher Company, Dept. AM-1114, Cincinnati 1, O.

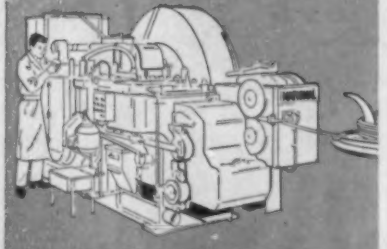


BOLTMAKERS make these interesting parts, and countless others, every day from wire.

Operations include cutting off, extruding, heading, trimming, pointing and thread-rolling.

It's just possible *your* metal parts can be made faster, stronger and at lower cost in Boltmakers (or in other types of Nationals).

May we help you investigate?



NATIONAL ½-INCH BOLTMAKER
4,200 PARTS PER HOUR!

NATIONAL MACHINERY CO.
TIFFIN, OHIO, U. S. A.
HARTFORD DETROIT CHICAGO

NEW FILMS...

HOW TO LOCATE FLAWS WITH DYE PENETRANTS. *Produced by Turco Products Inc, 24600 S Main St, Wilmington, Calif. 16mm, sound, color. Running time 23 min. No charge.*

Designed primarily for training purposes, the film demonstrates dye penetrant inspection from laboratory theory to production-line techniques. The theory behind the technique is described in detail, and the proper methods of insuring complete inspection accuracy are carefully outlined. By means of glass microslides fastened together to simulate a defect, the viewer is able to see exactly what action takes place when flaws are located in metal by dye penetrants.

•

"HOW TO HARNESS A RAM." *Produced by Globe Hoist Co, E Mermaid at Queen St, Philadelphia 18, Pa. Slide film, sound. Running time 15 min.*

Consisting of about 100 actual field photographs this film describes the use of hydraulic power for materials handling operations, including operating a cross-over bridge, raising boxes and crates from the floor, sustaining stockpile levels in machine feeding operations, and other lifting, loading, and positioning operations. Synchronized commentary is provided by a 12-in, 33 rpm record with bell signal.

•

RICE BOWLS TO ROCKETS. *Produced by Gray Iron Founders' Society, Nat'l City-E 6th Bldg, Cleveland 14, Ohio. 16mm, sound, color. Running time 30 min.*

Combining entertainment with education, this film is intended to set the stage for a complete set of nine film strips and movies which will cover the entire field of gray iron. It traces the history of gray iron castings from its early uses in ancient China to modern industrial applications, and stresses the economy and cost-cutting ability of the material.

Other films available in the series are 18-min film strips "What is Cast Iron?" "Properties of Gray Iron," and "Properties of Ductile & High Alloy Iron." Still in production are two 25-min movies, "Straight Line to Production," and "Machining, Grinding and Finishing," as well as three 18-min film strips, "Casting Design & Analysis," "Cost-Saving Design Tricks with Gray Iron," and "Patterns for Profit."

The entire program has been made possible by a grant to the Society from the American Coke and Coal Chemicals Institute, and the merchant coke producers of the country.

•

ESTABLISHING WORK STANDARDS BY SAMPLING. *Produced by University of California, University Extension, Los Angeles 24, Calif. 16 mm, sound, color. Running time 25 min. Price $2.50; also available for rental.*

The technique of work sampling may be used to measure tasks which formerly could not be studied for either technical or economic reasons. This new movie shows how it can be done. Using as an example, a shipping operation which involved generally established methods, plus many variables, the film demonstrates the use of the work sampling technique and how it may be used to set production standards for the operation. The technique should be of great value in such widely varying fields as customer servicing, warehousing, maintenance, and other activities involving nonrepetitive, nonroutine tasks. HEL

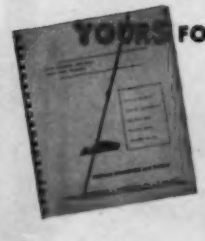
"I'm new here. How much should I hate the boss?"

Pioneers in the development of Power Steering, the Char-Lynn Company of Minneapolis has learned **from experience** that no other bore finishing method can match Sunnen Honing . . . for producing the precise dimensions and fine surface finishes so essential to dependable hydraulic performance.

Parts illustrated are components of a power steering pressure control valve for self-propelled agricultural equipment. Close tolerances on size and finish are held easily . . . **at good production rates** . . . through 2-stage honing on Sunnen Machines. Fast cutting, coarse grit stones remove stock to within a few thousandths of desired bore size . . . fine grit stones accurately produce final I.D. and finish.

HOW ABOUT YOUR PARTS?

Do they require accurate bore sizing, smooth working fits or tandem hole alignment? If so, investigate the advantages of fast stock removal plus the precision that only Sunnen honing equipment can provide. We'll be glad to demonstrate this equipment without obligating you in any way.



FOR THE ASKING — Bulletin #SP10 — a valuable assembly of honing data, covering Sunnen Honing Machines, Mandrel sets, Portable Hones, External Hones . . . and production rates on 99 typical applications.

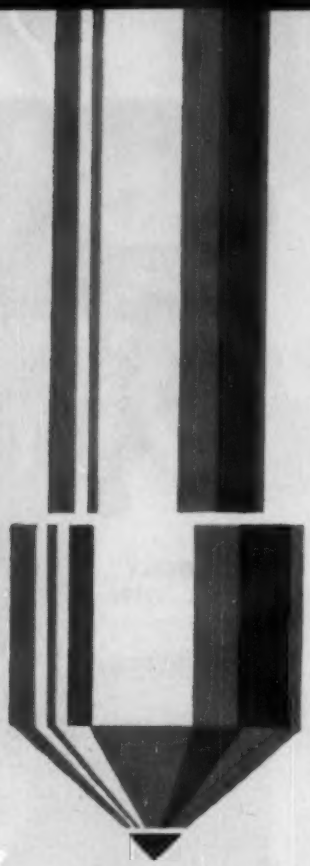
SUNNEN PRODUCTS COMPANY
HONING

7920 E. Manchester Ave. • St. Louis 17, Mo. Canadian Factory: Chatham, Ontario

Average installation of Sunnen Honing machine with tooling costs about $1,000.

8653

Diamond-impregnated tool



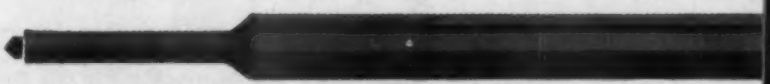
Truing tool

When you consider the job they do,

DIAMONDS CAN BE YOUR CHEAPEST CUTTING TOOLS

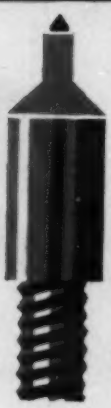
It's true that diamond tools may *seem* costly. But the real cost of any tool is the first cost divided by the work it does.

And diamonds usually work at higher speeds, do the job more quickly. Diamonds last longer, so tools don't have to be changed as often. Setups are reduced. Your people spend less of their time changing tools, more of their time operating machines.



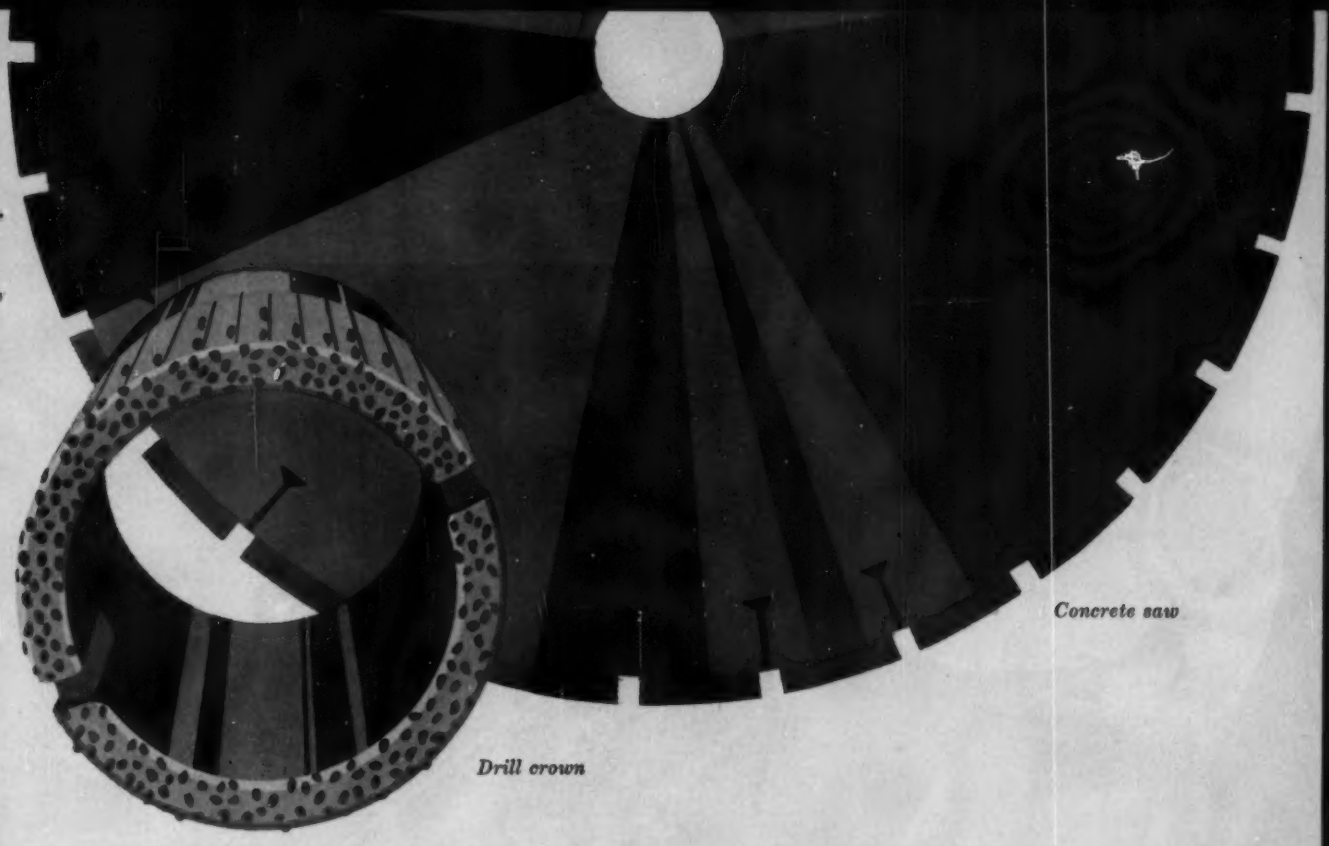
Engraving tool

Grinding wheel



Centering drill

CIRCLE 358 READER SERVICE CARD



Concrete saw

Drill crown

Just how inexpensive diamonds can be for you, depends on the job you're doing. You'll have to try them to know. The biggest companies in the country, the ones that watch costs most closely, use industrial diamonds consistently.

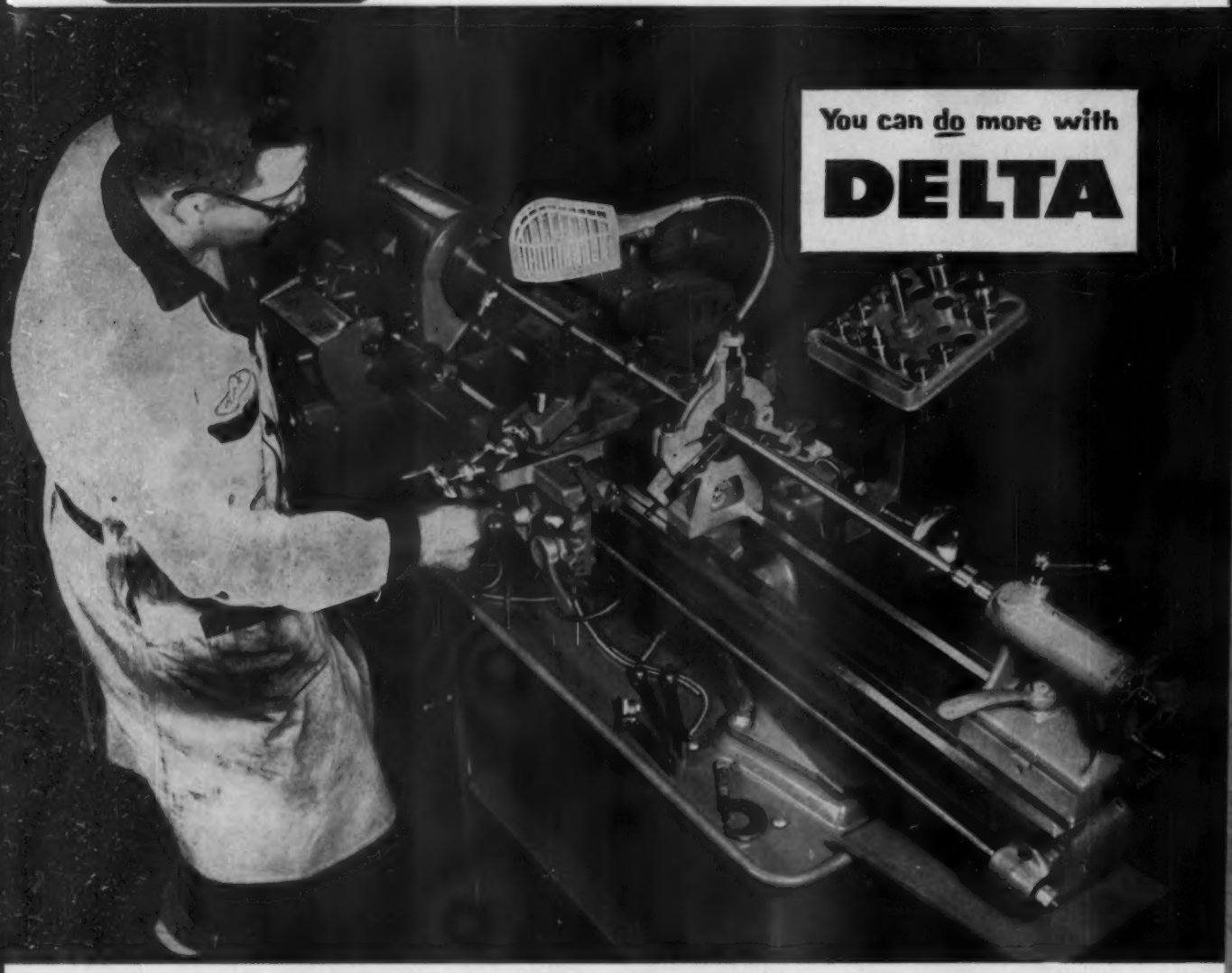
Next time you buy tools or wheels, try diamonds. Pit them against the cutting method you are now using. Chances are you'll find out how economical a diamond can be.

INDUSTRIAL DISTRIBUTORS (SALES), LTD., LONDON

Diamond shaping tool

CIRCLE 359 READER SERVICE CARD

INDUSTRIAL DIAMONDS CUT PRACTICALLY EVERYTHING . . .
ESPECIALLY YOUR PRODUCTION COSTS



NEW 'Long Bed' 10" Metal Lathe offers capacity up to 36"

Delta 10" Metal Lathe with Long Bed (36" between centers) available in bench or cabinet models with a complete line of accessories.

Now Delta introduces the "big brother" to the famous 10" Metal Lathe—with a big 36" capacity between centers and an exclusive combination of features that make it the big value in its class.

This new model fills the need for a low-cost, precision lathe capable of handling heavy duty work in production, in plant maintenance shops and in tool rooms. In addition to extra capacity, it provides: variable speed drive with choice of speeds from 50 to 1500 rpm, quick change gear box allowing selection of 54 feed rates or thread pitches, and ¾" collet capacity—largest available in any comparable lathe.

See your Delta Industrial Distributor (listed under "TOOLS" or "MACHINERY" in the Yellow Pages) about the many other extra performance features you get. For FREE catalog describing the complete line of Delta Metal Lathes, write: Rockwell Manufacturing Company, Delta Power Tool Division, WL-21 N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

DELTA INDUSTRIAL TOOLS
another fine product by
ROCKWELL

CIRCLE 360 READER SERVICE CARD

Mid-States Diversifies Product Line...

Consolidates Lubricant Inventory!

The past twenty years have seen Mid-States Steel & Wire Company greatly diversify their product line while they simplified their lubricants inventory. Today you would find at Mid-States, banks of nail-making machines pouring out over 35 tons of nails every day . . . new fence-making machines . . . machines producing hardware cloth, ornamental wire, baler wire, wire lath, welded fabric, window guards. The list could go on and on.

While the number of products has grown, Mid-States, with the cooperation of Cities Service Lubrication Engineer "Ken" Mosher, have constantly studied their lubrication requirements and have reduced the number of individual lubricants. Pacemaker oil serves as a hydraulic oil and also as a lubricant on many machines. Cities Service multi-purpose Trojan H grease does triple duty throughout the plant. Cutting oils and other lubricants are held to a minimum by selecting a quality lubricant to serve several applications. Reducing the number of lubricants saves valuable warehouse space and cuts the chance of error in servicing machines.

Call your local Cities Service office for a Lubrication Engineer to show you how you can reduce your lubricant inventory. Or for full information write: Cities Service Oil Company, Sixty Wall Tower, N. Y. 5, N. Y.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

EVERY SECOND A TOOL STANDS IDLE WHILE AN OPERATOR LOADS OR UNLOADS COSTS YOU MONEY

Any one of these BELLOWS-VALVAIR Air-powered Work Feeders can cut that idle time in half!

Need close tolerance indexing?

Model BRET-13B
13" diameter top
Factory set for either 4, 6, 9, 12 or 18 stations

Model BRET-26C
26" diameter top
Factory set for either 4, 6, 9, 12 or 18 stations (may be ordered for a maximum of 36 stations)

Extremely close indexing tolerances . . . that is the extra feature built into this group of Bellows-Valvair Rotary Index Tables. Built to rigid standards of workmanship and material, they provide a quality of performance unmatched in their field. These units, too, have built-in controls to regulate the indexing speed; they are complete units, just make the necessary electrical and air supply connections; they may be easily synchronized with other Bellows-Valvair equipment to build completely automatic, high speed special purpose machines.

Need high speed work positioning?

Model BRET-10C
10" diameter top
Adjustable for 4, 6, 8, 12 or 24 stations

Model BRET-22C
22" diameter top
Factory set for either 4, 6, 9, 12, 18 or 36 stations (may be ordered for a maximum of 72 stations)

These Rotary Feed Tables position work pieces with high accuracy, at a rate to match machine efficiency. The units are complete; require only mounting, attaching electrical connections, coupling with air supply. They may be mounted in any position thereby allowing a wide range of application for feeding a variety of work pieces in very simple or complex machine or processing systems. Indexing speed is easily controlled . . . two speed control screws on the Electroaire Valve® may be adjusted to regulate the rotating speed of the table top. Oversize table tops may be attached to the standard top.

How about 2-position shuttle feeding?

Model TF-60D
Table top is 8" x 26"
The two work stations may be adjusted from 3-5/16" to 6-1/8" apart

Removing a finished work piece and positioning a raw part at one station while a production operation is being performed at the other station . . . this is what the Bellows-Valvair Shuttle Feed provides and, by doing so, unloading and loading time does not interrupt the machining operation. Speed of movement of the top is easily adjusted by the control screws built into the Electroaire Valve controlling the Bellows Air Motor®. The unit is complete when received, ready to install and operate. And, it may be synchronized with other Bellows-Valvair equipment . . . a feature of all Bellows-Valvair "Controlled-Air-Power" Packaged Units.

872C

Bellows-Valvair
AKRON 9, OHIO
DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

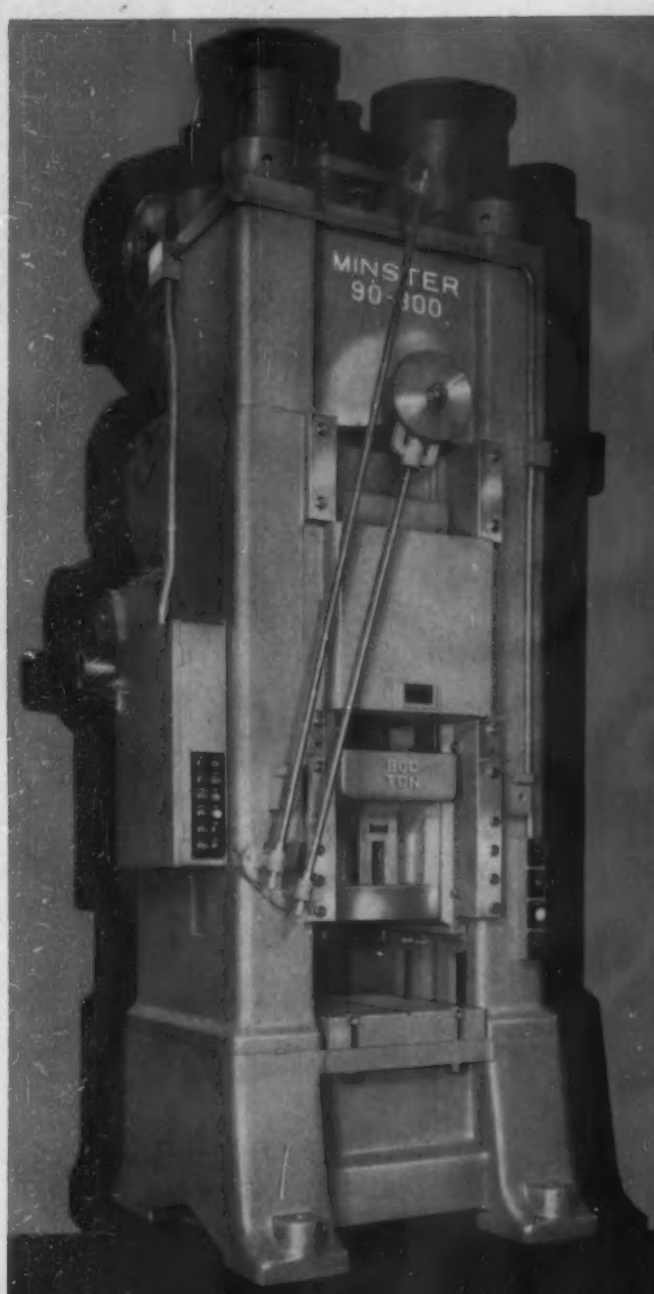
Bellows-Valvair, Division of IBEC, Akron 9, Ohio

Please send me full details on Bellows-Valvair Air-powered Index and Work Feeders. AM-1160

Name _____

Company _____

Address _____



These Outstanding Features Make

MINSTER®

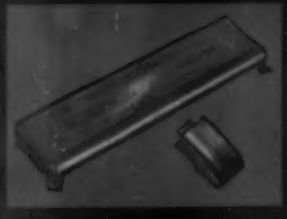
KNUCKLE JOINT PRESSES More Productive

- The Precision Built into the Press Gives You Greater Parts Accuracy—Longer Press Life
- More Single Stroke Operations per Minute
- Higher Speeds for Greater Velocity of Impact
- Positive Continuous Lubrication Provides Greater Precision, Reduced Wear, Less Maintenance
- Massive Frame and Tie-Rod Construction Withstands the Tremendous Forces of Knuckle Joint Press Work

SIZING

COINING

EMBOSSING



THE MINSTER MACHINE COMPANY

MINSTER, OHIO

EXTRA RIGIDITY of Chicago-Latrobe Drill pays off at Tool Show demonstration!

3" DIA. HOLE DRILLED THRU 3" OF STEEL IN JUST 52 SECONDS!

3" hole through 3" plate took just 52 seconds. Note perfectly formed chips that indicate continuous, vibration-free cutting even while operating at .100" rate of feed. Demonstration took place at Machine Tool Show.

A Chicago-Latrobe Service Engineer checks drill performance with Carlton operator. This C-L service is available to all drill users. Ask your C-L Distributor.

At the Chicago Tool Show the Carlton Machine Tool Company introduced its new 6 ft. Radial Drilling Machine. In one of the most dramatic drilling operations ever performed, they drilled a 3" diameter hole in a hot rolled steel plate 3" thick in just 52 seconds, operating at 45 RPM with a feed of .100" per revolution.

Chicago-Latrobe was asked to produce a drill for this demonstration. C-L engineers recommended the regular Type 110 High Speed Taper Shank Drill—*special in length only.*

Unbelievable strength is required for a twist drill to do a job like this, and C-L's exclusive method of producing large diameter drills made the Carlton demonstration possible. Chicago-Latrobe drills are manufactured from grooved stock—rolled to exact specifications; *twisted* to the correct helix; with the flutes and lands precision milled. This method gets the most from the steel—added torsional strength, maximum rigidity, *minimum disturbance to its molecular structure.* Specify Chicago-Latrobe for your tough jobs. Chicago-Latrobe products are sold by industrial distributors.

Get your copy of C-L catalog No. 60. Circle number, write direct, or ask your C-L distributor. Catalog 60 shows all prices.

CHICAGO-LATROBE

DRILLS • REAMERS • END MILLS • COUNTERSINKS • COUNTERBORES
SPECIALS • CARBIDE TOOLS • "LO-TORK" CHIP BREAKER DRILLS

416 WEST ONTARIO ST., CHICAGO, ILL.

this modern

CLEVELAND PRESS

embodies every essential feature for

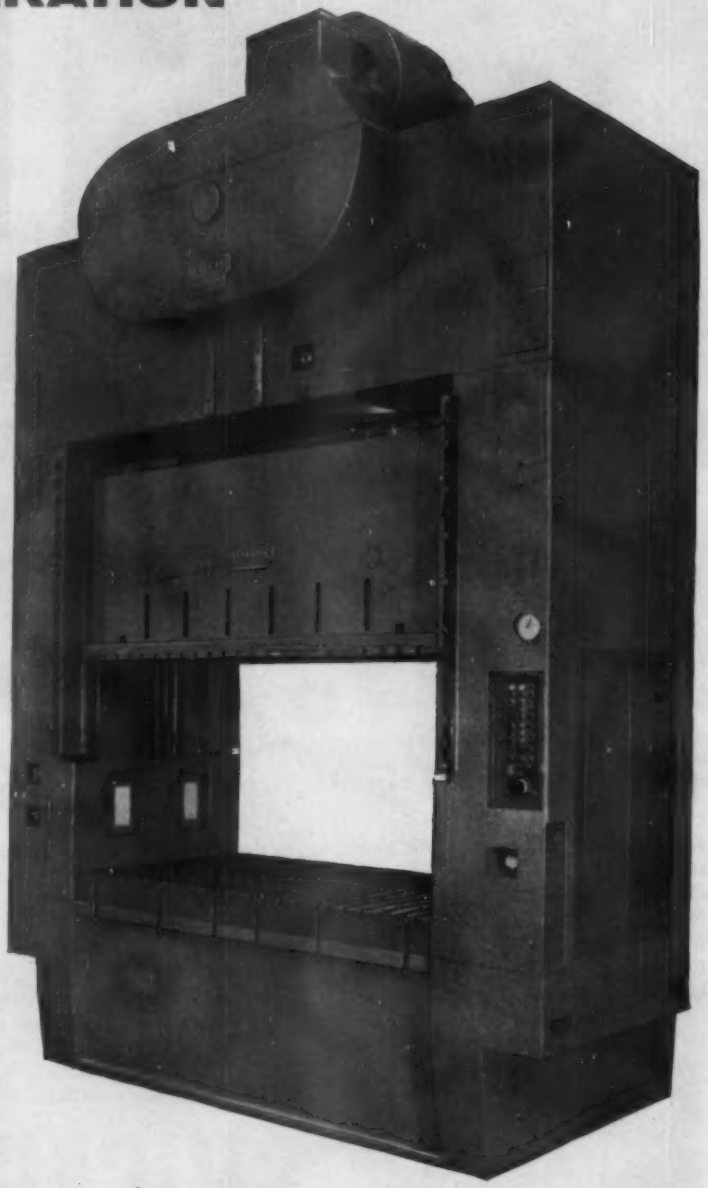
EFFICIENT OPERATION

Designed to produce many different types of stampings, this modern Cleveland Four Point Press already has proven its cost-cutting efficiency in automotive, appliance and other industrial pressrooms.

Features on this press are:

- Electrically controlled air-operated Cleveland (patented) Drum Type Clutch with spring loaded brake
- Air counterbalanced slide
- Pneumatic cushion in the bed, with controls for separate operation
- Auxiliary air brake on flywheel
- Lighted die area
- Gears completely enclosed, spray lubricated
- Stroke indicator
- Built to JIC Standards

Cleveland Four Point Presses can be furnished in a wide range of sizes, with capacities to suit particular requirements by modifying the stroke, adjustment, bed and slide areas. All models have this in common — maximum accuracy and die life . . . minimum maintenance and per-part costs . . . that's why it pays you to look into the advantages Cleveland Presses offer.



500-ton capacity, 24" stroke with 15" adjustment; shut-height 61½"; slide and bed both 72" x 144".

THE CLEVELAND PUNCH & SHEAR WORKS CO.
Established 1880

Power Presses
Fabricating Tools
Punching Tools & Dies

E. 40th and St. Clair Avenue, Cleveland 14, Ohio

A-1518A

Mr. S. E. Miller, Vice President and Division Manager of American Bosch Arma, shows the hundreds of items which go into the manufacture of a fuel injection pump (upper left of table).

IBM MOS

MANAGEMENT OPERATING SYSTEM SAVES AMERICAN BOSCH $120,000 YEARLY ON SHOP ORDERS ALONE

...TRIPLED SAVINGS ANTICIPATED WHEN SYSTEM IS EXPANDED!

American Bosch has turned to IBM's new systems techniques for faster, more sensitive control of its manufacturing cycle at the Springfield, Massachusetts, plant. Utilizing the IBM Ramac 305, the Management Operating System has been applied to Materials Planning and Inventory Management, and large savings have already accrued.

These additional savings are expected from methods now in use:

■ sharp reduction of machine setup costs. ■ standardized production levels, to minimize manpower fluctuations and concentrate inventory dollars on active sales items. ■ substantial time reduction in production schedule changes. ■ automation of annual standard cost revisions, with a 70% expense cut.

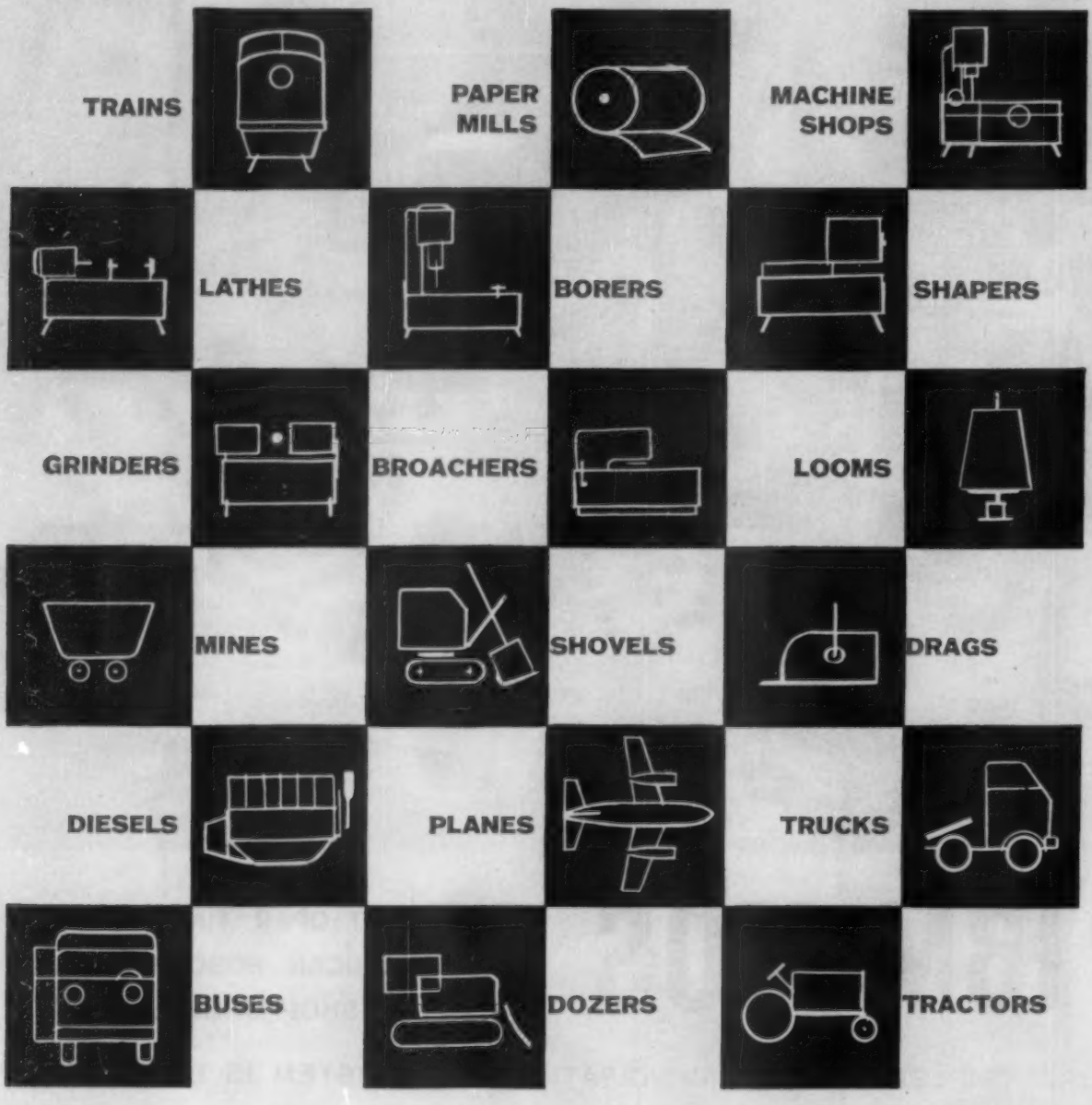
When the Management Operation System is extended to other areas, American Bosch estimates that savings will be tripled.

MOS can be applied to most industrial operations, with specially trained manufacturing representatives to assist you. IBM Balanced Data Processing provides comprehensive support in applying the system to your company's operation. For full information, call your nearest IBM office.

BALANCED DATA PROCESSING ▲ ®IBM

CIRCLE 367 READER SERVICE CARD

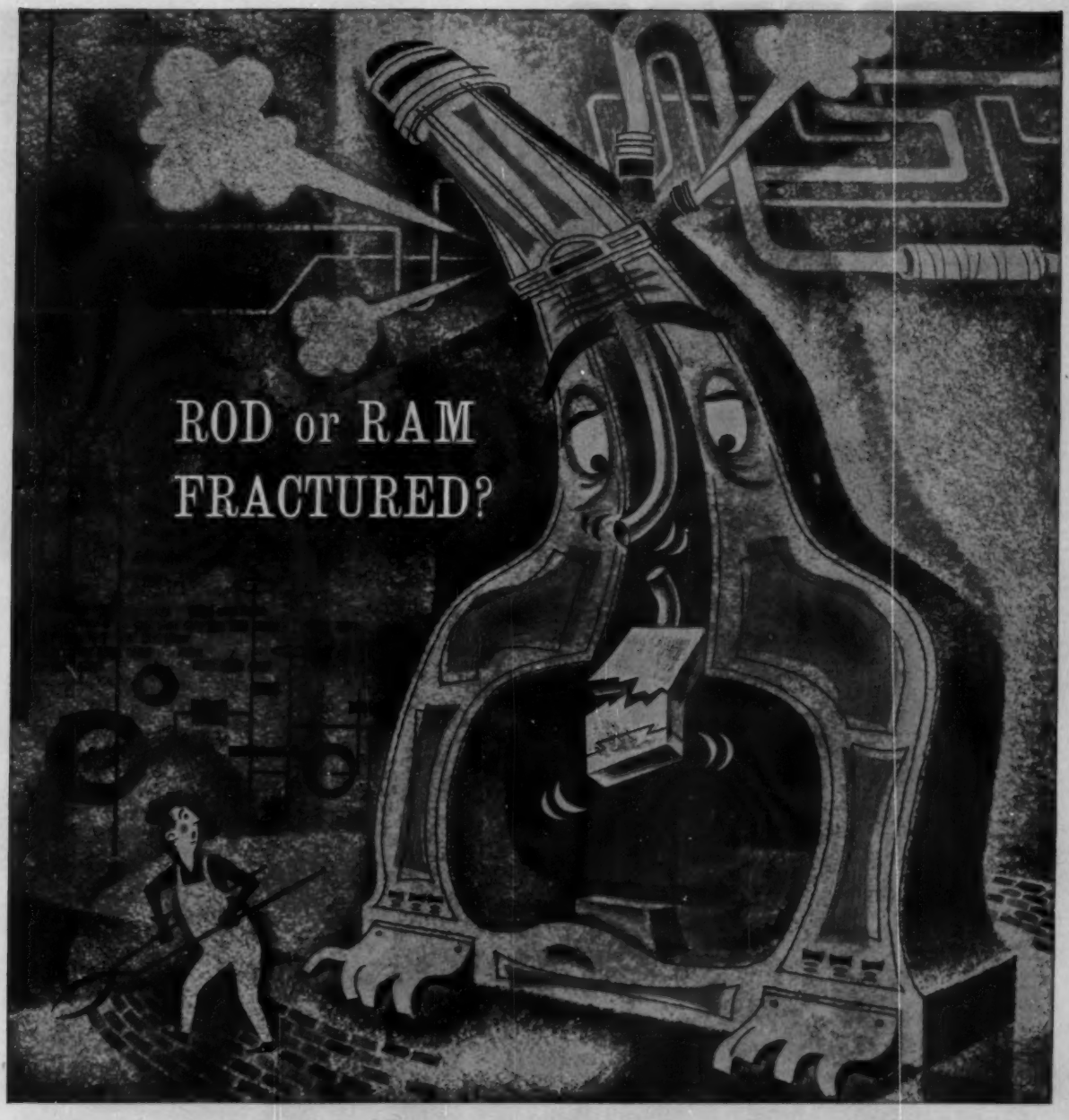
If you manage or operate any of these...



. . . your best move is to Sinclair's specialized greases, oils and lubricants, to cut costs, speed operations and increase profits. There are more than 500 of these money-savers, and each does its particular job particularly well. For helpful information based on actual experience, call your Sinclair Representative or write

Sinclair

SINCLAIR REFINING COMPANY
Technical Service Division
600 Fifth Avenue, New York 20, N. Y. • CI 6-3600



Call ERIE FOUNDRY for forging hammer replacement parts to your specifications

Replacement rods and rams, and many other parts for a wide variety of forging hammers of most any make are available from Erie Foundry. They are high in quality, competitive in price.

For over 65 years Erie Foundry has specialized in the design, development and manufacture of forging hammers of all types. Logically, then, Erie Foundry is a sure source for repair parts equal in quality and performance to the original equipment. Substantial inventories assure you of prompt service.

For more information on repair parts or our complete Rebuilding Service, write Mr. James Walker.

ERIE

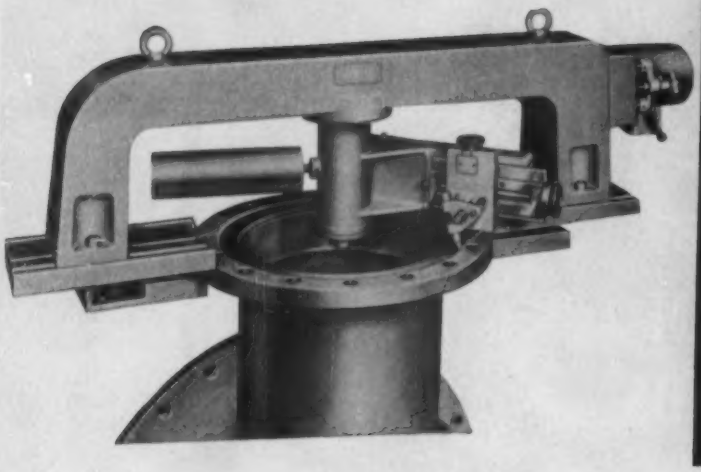
ONE OF THE GREAT NAMES IN FORGING SINCE 1895

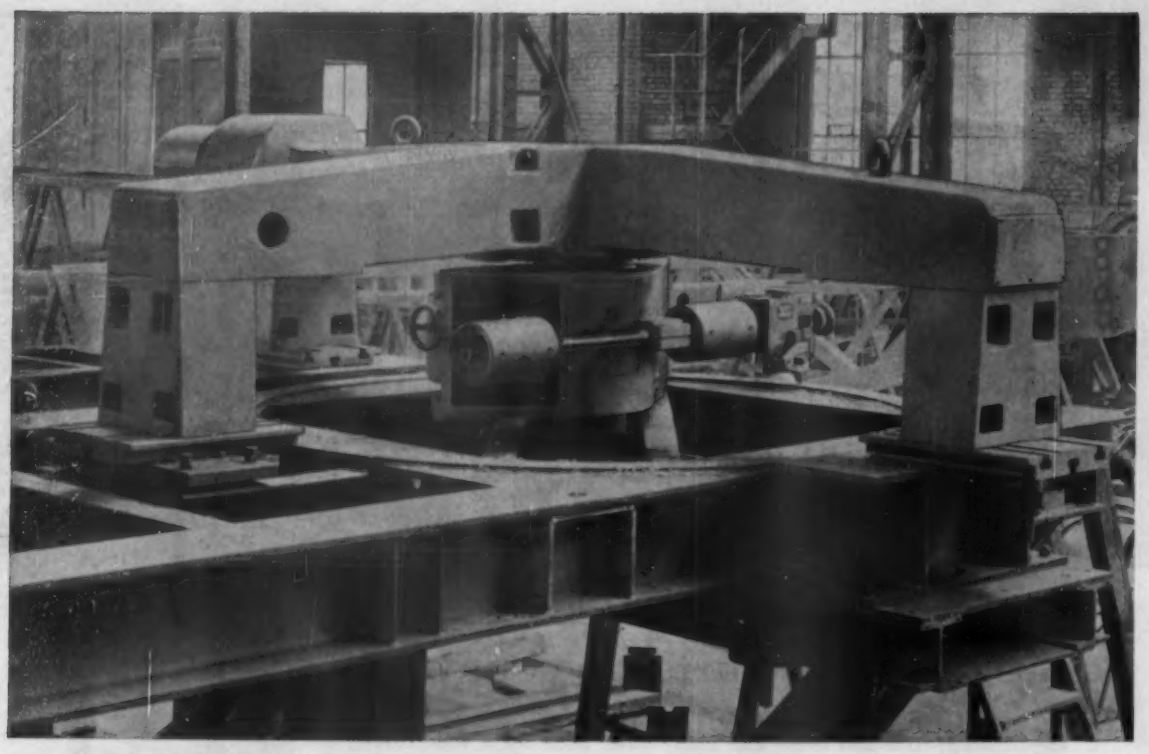
ERIE FOUNDRY CO., Erie, Pa.

Manufacturers of Forging Hammers • Forging Presses • Hydraulic Presses • Trimming Presses

EF-60-01

MATRA





MATRA-WERKE • GMBH • 301 • FRANKFURT/M. • GERMANY

NEW SMALL MAGNETIC STARTER COSTS LESS, SAVES SPACE ON LOW-HORSEPOWER JOBS!

Square D NEMA Size 00 Starter Rated ¾ to 2 Hp for 3-Phase Service

• You no longer need to buy more starter capacity than you can use for low-horsepower jobs! This new Square D Size 00 starter is compact, easy to install, simple to use and maintain—and it costs 18% less than the Size 0 starter you formerly had to specify to get the advantages of magnetic control! With no sacrifice in quality, this new starter provides: straight-through wiring—pressure-type terminals—1-piece overload relays for complete motor protection—pushbutton or selector switch optional in the cover. Also available without overload relays.

GET THE COMPLETE STORY! Write for Bulletin SM-297. Square D Company, 4041 North Richards St., Milwaukee 12, Wisconsin.

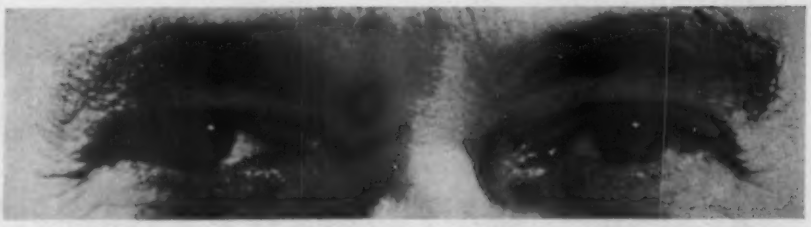
New starter is available either open or in NEMA Type 1 enclosure. Enclosure shown with selector switch in cover.

SQUARE D COMPANY

wherever electricity is distributed and controlled

WHO BUT REULAND

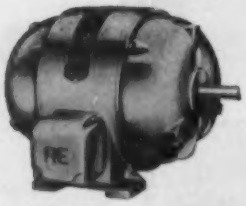
WOULD



OFFER AN

HONOR SYSTEM

MOTOR SERVICE POLICY?



15-Year-Old Service Policy Takes the Word Of Any Local Electric Motor Service Shop of Your Choice

Here is another indication of Reuland quality... and the extent to which our company stands behind its products. It is based on a trust in people, and a trust in Reuland workmanship. It has met the test of time, and captured the acclaim of Original Equipment Manufacturers... and *their* customers.

Whether *your* company is an O.E.M., or a User, the Reuland Honor System Service Policy can be your passport to uninterrupted machine operation. If you are tired of delays while service responsibility is determined... if you would like to talk to a motor company that can look you straight in the eye and be measured, your experience with Reuland could be a revelation.

A free copy is available on request. Explains the simple steps to take. Shows how Reuland's unique philosophy of doing business permits it to offer the industry's only Honor System Service Policy! All company officials should have a copy. We'll mail yours promptly.

MODERN POWER FOR MODERN DAY PRODUCTS
... all in lightweight aluminum frames!

REULAND MOTORS

REULAND ELECTRIC COMPANY
WESTERN DIVISION: *Alhambra, California*
EASTERN DIVISION: *Howell, Michigan*
Distributors in all Principal Cities

Gregory Grant says —

COMPARE THE COSTS!

MAKE YOUR OWN COMPARISON . . .
CALL ANDREW 8-4409 COLLECT

Here is a typical comparison — 50 sets of gears and pinions to meet assembly specifications:

Set of stock gears unaltered	$20.20	Set of Grant customized gears to your specifications, ready for installation
Rebore shaft hole/per pr.	.80	
Cut keyway/per pr.	.50	
Drill and tap for set screw/per pr.	.40	
	$21.90 pair	$15.75 pair

We believe we can prove on your next O.E.M. application that you can save 25% in actual costs when you specify Grant *customized* gears, instead of making time-consuming alterations to stock gears to fit your needs.

So call us — collect — we will gladly quote on your needs, no obligation, of course.

CALL COLLECT — THE NUMBER IS ANDREW 8-4409 FOR THE BEST IN CUSTOMIZED GEARS.

ESTABLISHED IN 1877

GRANT GEAR WORKS, INC. WEST SECOND STREET, BOSTON 27, MASS.

• *Catalog Available on Customized Gears* • *Precision Gears* • *Speed Reducers*

CIRCLE 373 READER SERVICE CARD

TAPEnology...industry's newest cost-cutting tool

See how "sticks-on-both-sides" TAPE *makes machining difficult parts easy*

Materials too small or too soft to be held properly during machining or finishing operations? Try holding them firmly in place with "SCOTCH" BRAND Double-Coated Tape No. 400.

This unique tape that "sticks-on-both-sides", holds materials with a vise-like grip. Holds parts precisely in place during drilling, cutting, grinding, milling and polishing operations. "SCOTCH" Double-Coated Tape is also ideal for holding copper, brass, and other non-ferrous metals incapable of being properly held by a magnetic chuck.

Applied in seconds—"SCOTCH" Double-Coated Tape sticks at a touch. Yet, removes quickly and cleanly without leaving residue. Available in widths up to 46 inches for larger mounting applications.

What do you manufacture? The ingenuity and technical resources of your 3M Representative are at your service. Ask your nearest "SCOTCH" BRAND Tape Distributor or write: 3M Company, 900 Bush Avenue, St. Paul 6, Minn., Dept. IAA-110.

When tape costs so little, why take less than...

REG. U.S. PAT. OFF.

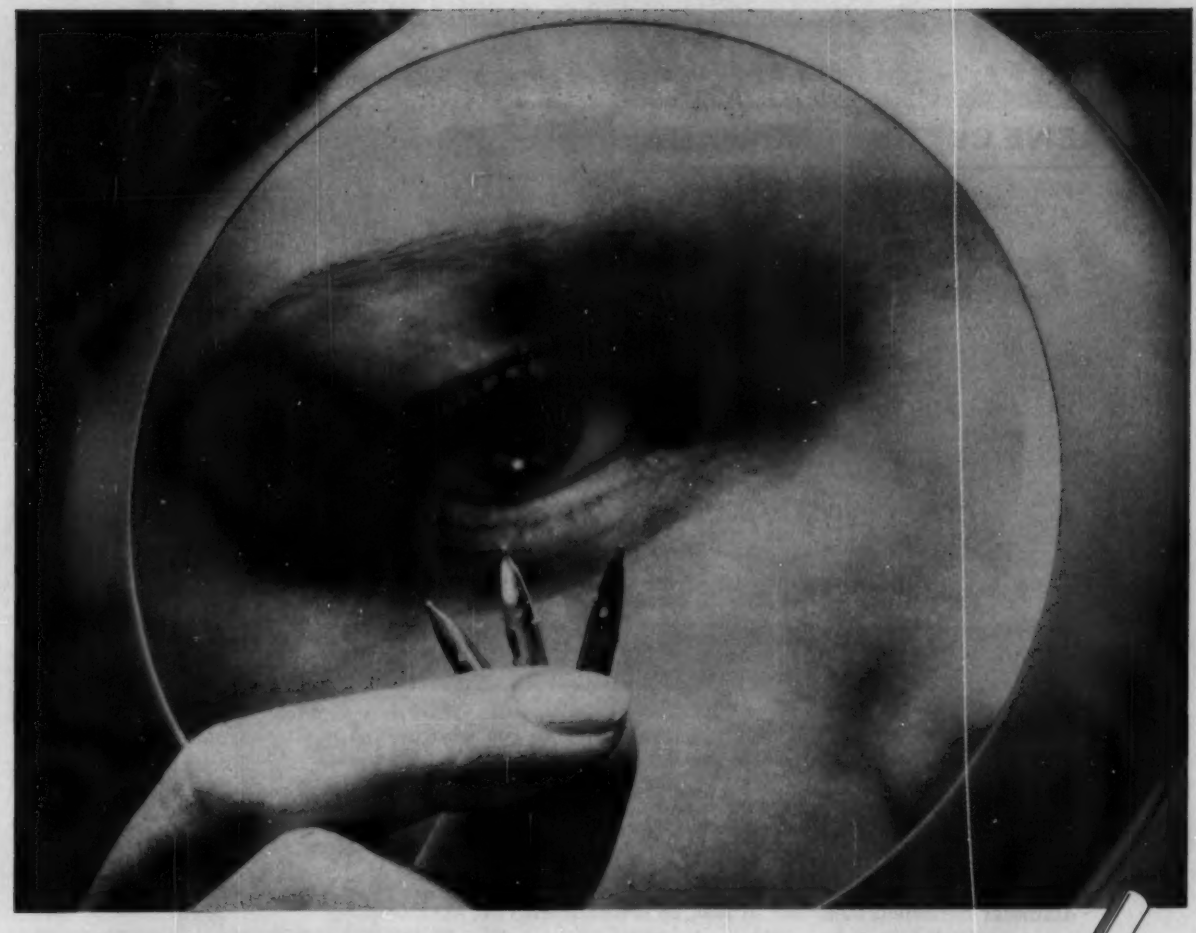
SCOTCH BRAND

"SCOTCH" IS A REGISTERED TRADEMARK OF 3M CO., ST. PAUL 6, MINN.

MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY



ALMCO Precision Finishing Gets to the Point.

At the Parker Pen plant in Janesville, Wisconsin, nibs for the famous Parker Pen are carefully examined (as shown). The writing surface must be flawlessly deburred and polished before being attached to the pen barrel in final assembly.

Almco precision finishing equipment does the job quickly and efficiently! Both conventional units and the new Vibratory machines are used at Parker to help make fountain pens that resist pressure, friction and abuse.

Almco's modern machines and methods—the Supersheen System—can help you achieve fine finishing results too. At Almco you receive trained counsel for your finishing problems . . . free sample processing in Almco's modern labs . . . skilled guidance in selecting the proper standard or custom-designed Almco machines and methods. Write today on your letterhead asking for an Almco sales engineer to call. Or send parts direct to Almco's lab with specs required.

Parker Pen barrels are Almco precision finished too! Almco Vibratory units can do the work 100 times faster than conventional finishing machines.

NEWS ABOUT ALMCO'S NEW PRODUCTS!

New brochures now ready on Almco spindle machine, Vibrasheen, other cost saving units. Price list on Almco compounds and media included. Send for your Almco Album of New Products today!

ALMCO

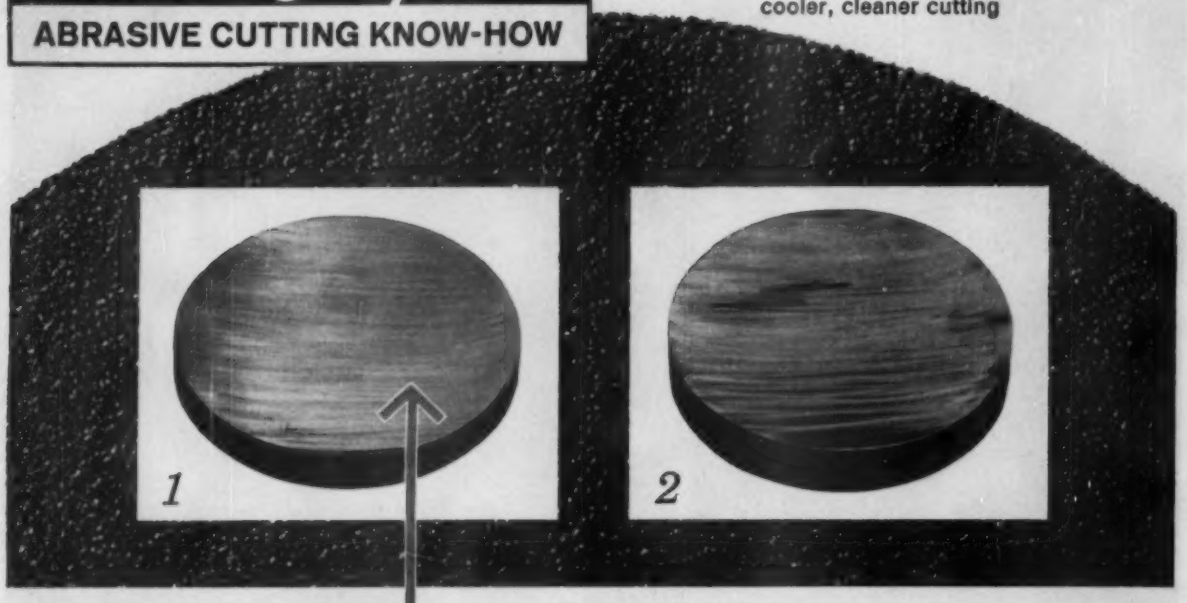
PRECISION FINISHING

Queen Products Division • King-Seeley Corporation

511 E. Main Street, Albert Lea, Minnesota

Allison-Campbell

ABRASIVE CUTTING KNOW-HOW



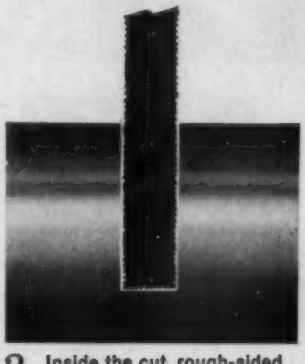
Close-up view of resinoid wheel shows rough texture that provides cooler, cleaner cutting

This CLEAN cut was made with a ROUGH-SIDED wheel!

1 • **THE SPECIMEN ON THE LEFT ABOVE** was cut from a 3¾" diameter hardened steel bar in just 28 seconds with an ALLISON *rough-sided* dry abrasive cutting wheel like the one shown in the background. Note that the cut is clean and practically burn-free.

2 • The specimen on the right was cut under the same conditions and with a wheel of the same formulation, but *without* rough sides. The result—the cut took 30 seconds and produced a badly burned surface.

3 • The secret is the extra clearance the rough sides give *inside* the cut (as shown in the small picture at right), and the resulting *cooler* cutting action. This adds to wheel life, too. That's why, for the dry abrasive cutting of solid bars, heavy-wall tubing and structural shapes, ALLISON-CAMPBELL field engineers generally recommend rough-sided wheels.



3 Inside the cut, rough-sided wheels give extra clearance, extra cooling for faster cutting and to prevent burning

For dry cutting of thin-wall tubing with minimum burr, a fine-grit, *smooth-sided* wheel is the choice. And for *wet* abrasive cutting, dozens of ALLISON wheel specifications are available to match the material you are cutting, the quality you require, and the cut-off machine you use.

Regardless of your cut-off problems, your ALLISON-CAMPBELL field engineer can help you choose the wheels that will give the results you want. He is an abrasive cutting specialist—use his know-how.

Write for **Bulletin DH-214A** *for details on the complete line of ALLISON wheels*

ACCO

ALLISON ABRASIVE CUTTING WHEELS

Allison-Campbell Division • American Chain & Cable Company, Inc.

923 Connecticut Avenue, Bridgeport 2, Conn.

HERE ARE PROGRESSIVE STEPS IN THE EXTRUSION OF AN AUTOMOTIVE BEARING RACE

1. Metal starts as ¾" diameter cut-off from coil stock.
2. Impacted to 1-1/16" diameter.
3. Extruded to configuration.
4. Finished extrusion.

JUST THAT QUICK

EXTRUDOIL #51 DO CONCENTRATE

helps cold extrude another bearing race... does a better job regardless of type of equipment used.

IN COLD EXTRUSION, SUCCESS DEPENDS ON LUBRICATION and Macco Extrudoil #51 DO Concentrate provides the RIGHT KIND OF LUBRICATION for SPARK PLUG SHELLS • SCREWS • GEARS • BEARING RACES • TAPPET BODIES • SLEEVES • BOLTS • WORM SHAFTS and a host of other precision parts.

ARE THESE ADVANTAGES OF INTEREST TO YOU?

REDUCES PRODUCTION COST . . . INCREASES PRODUCTION DUE TO LESS DOWN TIME BECAUSE OF TOOL CHANGES

FREER FLOWING OF METAL ASSURES MAINTENANCE OF ABSOLUTE TOLERANCES

CUTS INVENTORY COST—ONE LUBRICANT DOES ALL THE JOBS

CUTS DIE TRY-OUT TIME

Macco Extrudoil #51 DO Concentrate is the first choice of experienced extrusion men because Macco research and development, working hand-in-hand with leading extrusion equipment manufacturers, developed this lubricant to meet the distinct needs of cold extrusion. It works better! Macco Extrudoil #51 DO Concentrate is far ahead of the field . . . proved in production beyond question . . . used every day for the most demanding jobs. A trial will prove it to you.

If you are now engaged in cold extrusion, or even thinking about it, it will pay you well to talk to a Macco engineer, and find out for yourself why

THE METALWORKING INDUSTRY LOOKS TO MACCO FOR LEADERSHIP

MACCO PRODUCTS COMPANY

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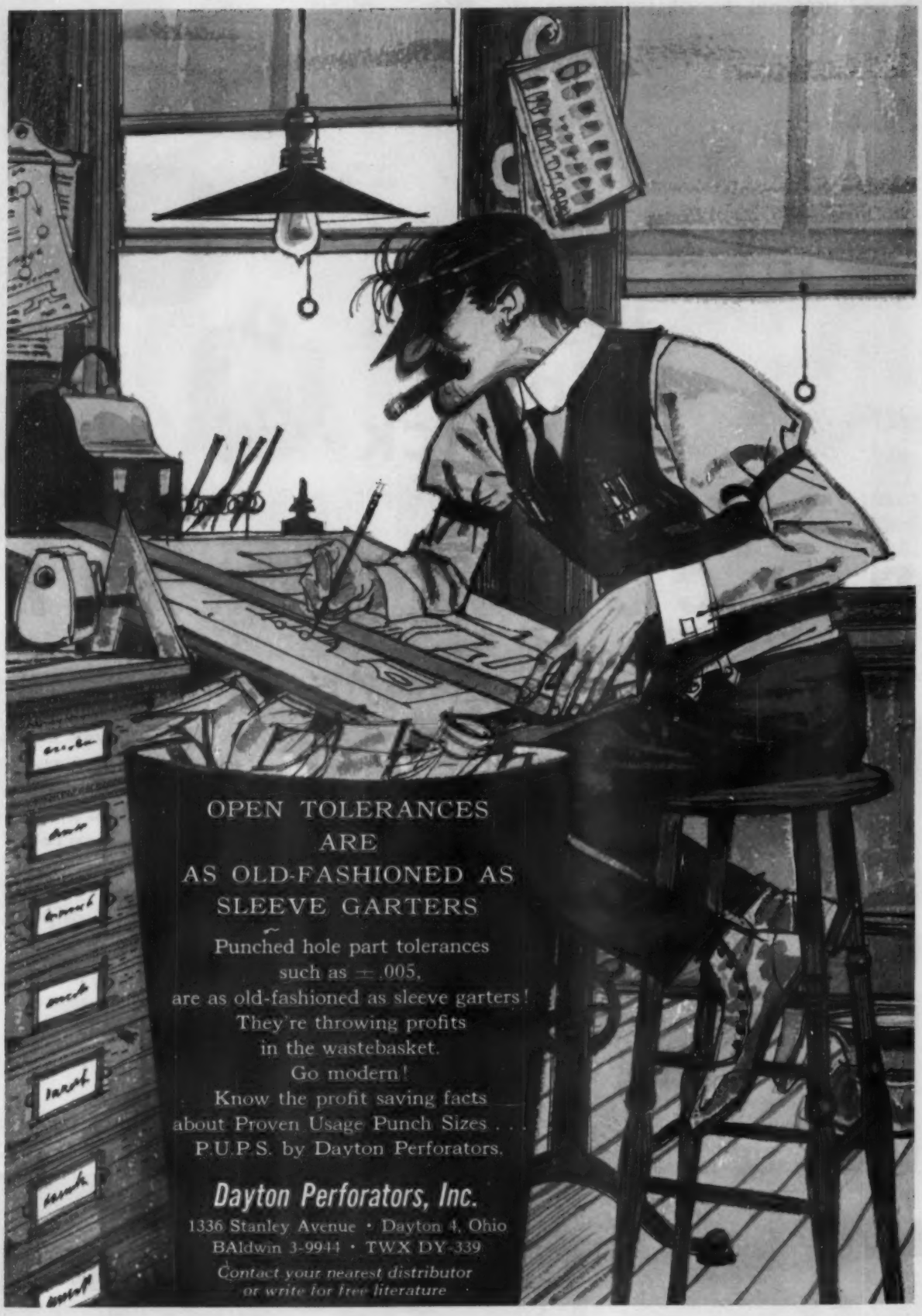
CIRCLE 377 READER SERVICE CARD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ARE
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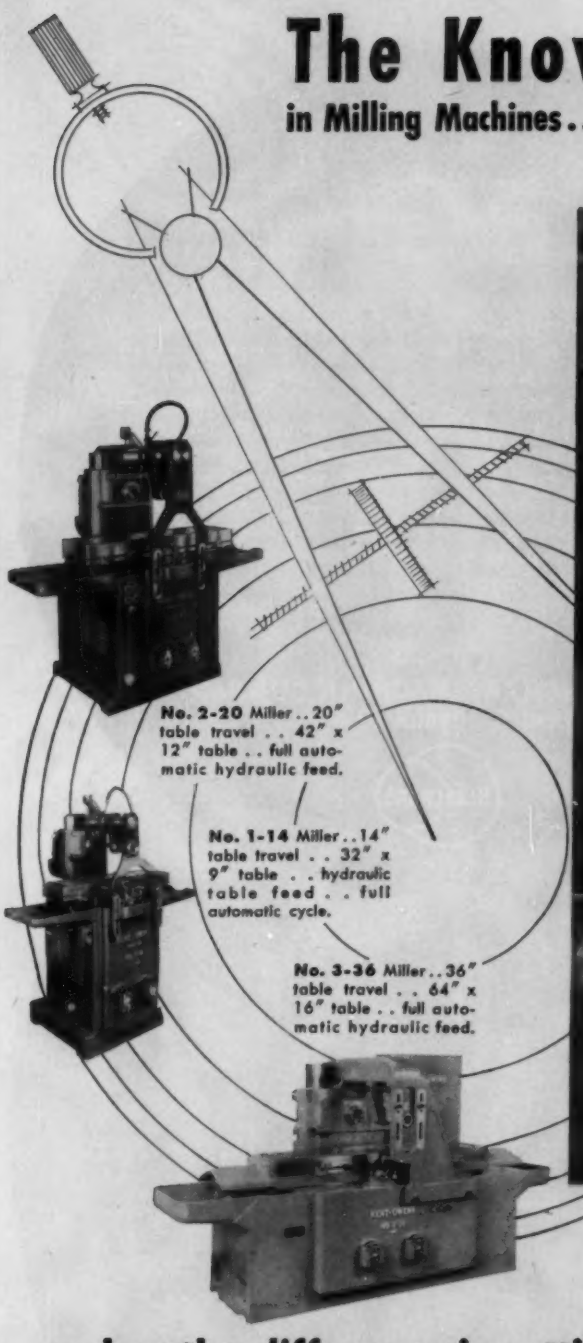

No. 2-20 Miller..20" table travel . . 42" x 12" table . . full automatic hydraulic feed.

No. 1-14 Miller..14" table travel . . 32" x 9" table . . hydraulic table feed . . full automatic cycle.

No. 3-36 Miller..36" table travel . . 64" x 16" table . . full automatic hydraulic feed.

A section of our assembly floor showing Automation-Type Machines in process of manufacture.

. . makes the difference in cutting costs . . increasing production

Know-How, born of years of experience, abetted by sound and imaginative design and quality manufacturing standards . . . is the reason why many of our customers, representing a wide and diversified coverage of industry, come back to us again and again for *answers* to their production problems.

When you are considering procurement of machinery for your milling needs . . . or seeking the solution to other production problems . . . you may wish to consider a Kent-Owens Milling Machine or a Special Machine designed for a distinctive and individual application. Contract Machine Building (customer designed equipment) is another of our specialties.

Write or call . . . Kent-Owens will be pleased to quote your requirements. Kent-Owens Machine Company, Toledo 10, Ohio.

KENT-OWENS *Designers and Builders of Milling Machines and Special Machinery*

NEW

The No. 18-A2 Blanchard Surface Grinder ... a modern Two-Spindle Automatic that is accurate, fast and versatile!

This new Blanchard Grinder of advanced design offers you many important features, all adding up to better, faster surface grinding. The No. 18-A2 Blanchard is a versatile, rugged, hard-working machine. It is of a "dry base" design: in operation, all coolant and chips flow to an outside settling tank, separator, or central coolant system. Easy access is provided to the grinding wheel area, and push-button stations and operator's control are conveniently located for ease of set-up. All controls are interlocked, guaranteeing complete safety. Whenever grinding wheels require replacement, a warning light flashes at the operator's station. The No. 18-A2 Blanchard may be equipped with 30, 40 or 50 HP, foot-type spindle motors. This grinder can also be provided with 40" magnetic chuck or 43" plain table for special work holding fixtures.

THE BLANCHARD MACHINE COMPANY
64 State Street, Cambridge 39, Mass., U. S. A.

BLANCHARD

V-562

Photo Courtesy of the Pierce Wrapping Machine Company, La Grange, Illinois

STROBOTAC *for Design Analysis*

This toroidal winding machine for the spiral wrapping of tires, steel coils, rugs, and other products was designed with the aid of the Strobotac. Only under stroboscopic light could the intricate behavior of the wrapping mechanism be studied as the paper was being wound.

In the design of machinery of this type there is no better way to determine whether the various machine parts are operating as planned than to watch the progress in "slow motion" under stroboscopic light. The Strobotac's high-intensity light flashes of a few microseconds duration reveal flaws or machine eccentricities as no other equipment can. The Strobotac also serves as a handy device for speed measurements to 250,000 rpm and above.

Type 1531-A Strobotac® Electronic Tachometer and Motion Analyzer . . . $260.

Strobotac features which Pierce Wrapping's Chief Engineer indicates are advantageous in his work include:

"The high-intensity white light enables measurements to be made under normal plant lighting, eliminating the need for a previously used darkened room."

"Greater stability of the new Strobotac eliminates the necessity of continuously jiggling the dial to keep the machine synchronized."

"Simplified dial and range-switch arrangement for easy reading."

"The multi-position reflector and lamp can be easily moved around and pointed to best advantage at the inside of the machine without the necessity of repositioning the entire instrument."

"The very well-designed case allows you to close up the unit at a moment's notice and leave it in the shop, while you go back to Engineering to do a little calculating."

CHECK THESE SPECIFICATIONS and see how the new Strobotac will aid you in design and analysis of machine operations — whether it be rotating, reciprocating, or any type of cyclic movement.

Intense, white-light — more than 70 times brighter than previous model.

Extremely short duration flash (1 to 3 μsec) practically eliminates blur — "freezes" motion — shows details heretofore impossible to see.

Measures speed directly with ±1% accuracy to 25,000 rpm — useful to at least 250,000 rpm.

Long-throw beam reaches into the heart of complex machinery — made possible by new flash tube developed exclusively for this instrument.

U. S. Patent Numbers: 2,478,901; 2,478,907; and 2,492,142
Patent Pending; Patent Applied For.
Licensed under designs, patents and patent applications of Edgerton, Germeshausen and Grier.

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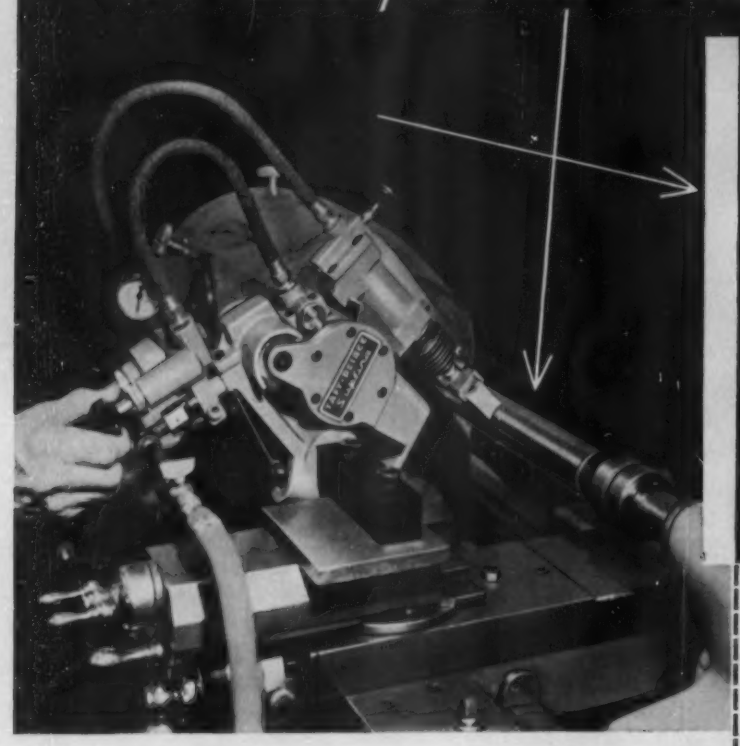
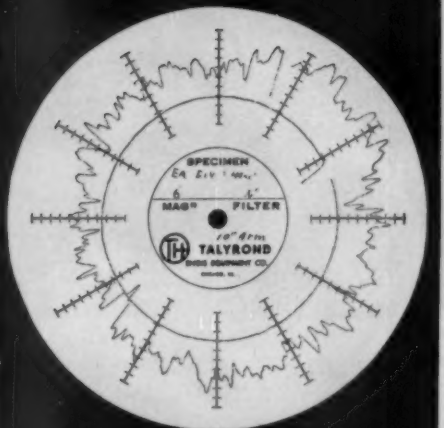
CIRCLE 381 READER SERVICE CARD

THE NEW WORD IN METALWORKING IS MICROSTONING!

NOW! SIMPLIFIED, LOW-COST CORRECTION OF SURFACE GEOMETRY WITH TAFT-PEIRCE / SUPFINA MICROSTONING





This dramatic "before and after" evidence on a Talyrond chart shows how Microstoning corrected the surface geometry of a die set guide pin. The outside trace shows an average roundness of .00028" as ground. After Microstoning (inside trace), the roundness was improved to an average of .000030"

Here's what happens . . .

Microstoning is a low-pressure, low temperature abrading process using stones of various grit sizes. Stones are placed against the work with light pressure and vibrated from 1900 to 2500 times a minute as the workpiece rotates. The stones shape themselves to the mean radius of curvature, and more pressure is applied at high spots. This produces a fast and simplified correction of surface geometry that is demonstrated graphically by the Talyrond chart above.

Microstoning with Taft-Peirce/Supfina machine tool attachments produces a controlled microinch surface finish, removes cutting tool marks and grinding flats, and dramatically improves roundness.

The unique, patented Supfina design makes this precision surface correction possible. A free-floating piston, driven by compressed air oscillates an abrasive stone at high frequencies against the work — to achieve both desired finish and geometric correction in ONLY ONE OPERATION! All types of metals can be microstoned as well as hard plastics and other nonmetallic materials.

Try Microstoning on your product! Taft-Peirce/Supfina Attachments are low in cost and simple to operate. They can be used on lathes, boring mills, planers and other machines — to produce a precision surface and improve the performance of spindles, sealing rings, metal processing rolls, and bearing surfaces. Microstoning can be used on both flat and round surfaces. Contact your nearest Taft-Peirce Machine Tool Dealer for full information or write direct.

Finish it with **TAFT-PEIRCE** *SUPFINA*

TPS-19

TAFT-PEIRCE MANUFACTURING CO., 13 MECHANIC AVENUE, WOONSOCKET, RHODE ISLAND

ELIMINATE UNNECESSARY ASSEMBLY COSTS with

Replace improvised units with readily available precision cam followers.

McGILL®

CAMROL® BEARINGS

CF (Cam Follower) SERIES

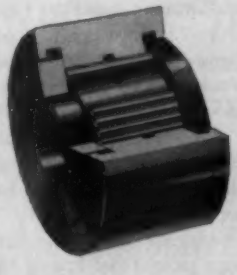
The original and still unsurpassed anti-friction roller bearing cam-follower bearing that adds efficiency at less cost to cam actuated, track and support roller applications. Built with full roller complement and integral stud, the CF series design provides high radial capacity and shock load protection in a compact roller with its own shaft. Easily applied and available in roller diameters of ½" to 4".

for the ultimate in:

- RADIAL CAPACITY
- SHOCK RESISTANCE
- SPACE ECONOMY

SCF SERIES.

Sealed to keep contamination out and lubricant in. It is dimensionally interchangeable with the CF bearings. A turned groove in the center of the outer raceway bore provides a permanent lubricant reservoir to approach life-time lubrication requirements. Can be easily re-lubricated.



SCYR SERIES (sealed)

CYR (Cam Yoke Roller) SERIES

The CYR series increases the adaptability of the CF bearing to all types of automatic machinery involving cam action or controlled-motion machine parts that require guide or support rollers. An inner ring replaces the stud for cam yoke roller mountings.

Write for Catalog No. 52-A for full information on McGill's needle roller bearings, and cam followers. Ask about recommendations for high precision special ball and roller bearings.

SCYR SERIES

This series provides a fully sealed Cam Yoke Roller type bearing. It is dimensionally interchangeable with the CYR bearings.

engineered electrical products

McGILL®

precision needle roller bearings

McGILL MANUFACTURING CO., INC., Bearing Division
300 N. Lafayette Street, Valparaiso, Indiana

CIRCLE 383 READER SERVICE CARD

PRECISION Quarterly NUMBER 7

PRECISION WELDER AND FLEXOPRESS CORPORATION, 3520 Ibsen, Cincinnati 9, Ohio

Success Buys Success

CINCINNATI—When you need a new machine you believe your own eyes first, and the manufacturer's superlatives second. Right? You go to watch a similar machine operate in a competitor's plant, or, as Packard used to say, you "ask the man who owns one." Right?

Something of the sort seems to be happening in the electrical components industry, where a good deal of watching the other guy's operations goes on. Word has been getting around that Precision machines are worth keeping an eye on. We've even heard it said that difficult jobs for resistance welders or high productivity presses become easy if you call in Precision Welder and Flexopress Corp. of Cincinnati. This we will be the first to deny.

Difficult jobs don't come easy, even for Precision Welder and Flexopress. But they become *solved*, like that dual-head assembly-welder in the picture. We built it for a big maker of communications equipment, so that your telephone dial can go on spinning for a million numbers without cracking up. Or the foil-butt-seam welder we built to make big pieces of steel out of little pieces, so that an automobile maker can use good metal that would otherwise have become scrap.

Or the high speed-press we built with an intelligent feed that gages position by the design lithographed on the metal it is stamping.

But enough of this blowing our own horn. We asked the men who bought Precision equipment what they thought and we got answers like this:

"We buy high quality, high cost equipment because it produces high quality, low cost products. And on those, we can make money."

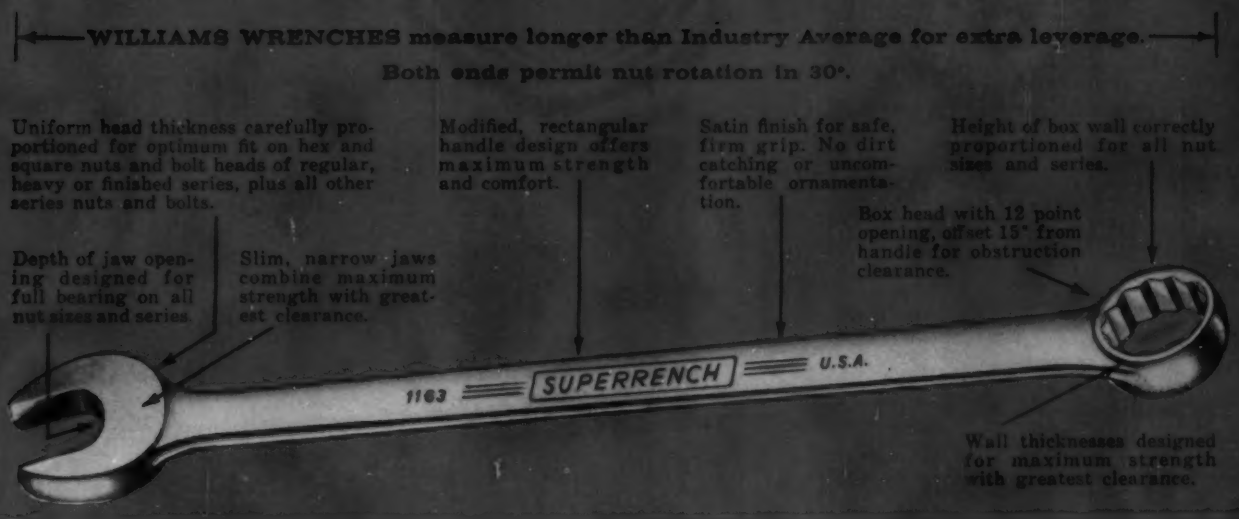
"We bought a Flexopress because it was guaranteed to exceed specifications —and it does. Seems to me that justifies a higher price."

"We're joining expensive, critical components. They can't be reworked, we can't afford scrap, and we have to guarantee a high level of reliability. Under such circumstances we naturally look for equipment – like Precision makes—that guarantees the kind of reliability we have to guarantee our customers in turn."

Gosh.

Right at the moment we are building automated resistance welders and high productivity presses for successful manufacturers whose success depends on a foundation of quality equipment. Without hesitation, we recommend the same system to you. You might call us about it today. You'll find our number is on the dial above.

PRECISION


WILLIAMS WRENCHES measure longer than Industry Average for extra leverage.
Both ends permit nut rotation in 30°.
Uniform head thickness carefully proportioned for optimum fit on hex and square nuts and bolt heads of regular, heavy or finished series, plus all other series nuts and bolts.
Modified, rectangular handle design offers maximum strength and comfort.
Satin finish for safe, firm grip. No dirt catching or uncomfortable ornamentation.
Height of box wall correctly proportioned for all nut sizes and series.
Box head with 12 point opening, offset 15° from handle for obstruction clearance.
Depth of jaw opening designed for full bearing on all nut sizes and series.
Slim, narrow jaws combine maximum strength with greatest clearance.
1163
SUPERRENCH
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Wall thicknesses designed for maximum strength with greatest clearance.

You need both... QUALITY DESIGN QUALITY MANUFACTURE

IT'S A PUSH BUTTON WORLD AT WILLIAMS
This three station transfer machine drills, broaches and chamfers box openings to close Williams' tolerances.

Open-end heads are broached to extremely close tolerances on this two station vertical ram machine.

You get the most for your money when you buy WILLIAMS!

You get the most for your money when you buy any tool, wrench or stock forging from Williams' broad line of 4530 stock catalog items.

THE BROADEST LINE OF ITS KIND

MR. WRENCH SAYS: "Get the Facts ... get TOOLFACTS ... new 24 page booklet on how to select, use and care for Quality Wrenches."

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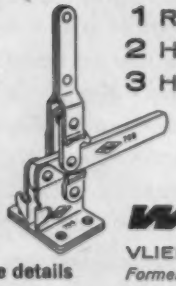
80 models and sizes...

made better three ways to give more positive holding, last longer!



1 Reamed holes
2 Hardened serrated bushings
3 High tensile strength rivets

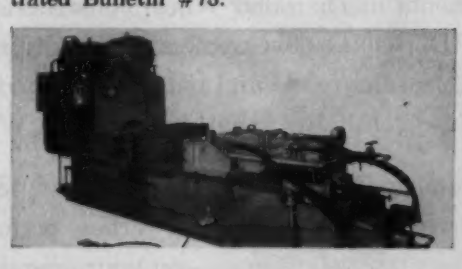
send for free catalogs describing Wespo clamps and fixture details

WESPO DIVISION
VLIER ENGINEERING CORPORATION
Formerly West Point Manufacturing Company
26935 W. Seven Mile Road • Detroit 19, Michigan

Parts formed by 100-ton Williams-White Bulldozer at Chicago plant of Joslyn Manufacturing and Supply Company. Holes are drilled in previous operation.

150% production boost -- 2 steps eliminated with Williams-White hydraulic Bulldozer

The job: Form a hot rolled steel workpiece, ½" x 4" x 42", in one operation. Previously, this tough assignment took 3 strokes of a press. Production rate was 40 parts per hour. NOW — a 100-ton Williams-White Bulldozer with hydraulic cushion, utilizing special tooling by Joslyn engineers, forms the hot steel in one squeeze. Current production rate: 100 parts per hour. The production increase and elimination of 2 steps in this application are typical of results gained with Williams-White heavy machinery and skillful tooling. Check into the time and money-saving advantages of metal forming equipment built by Williams-White, originator of the bulldozer. Write for illustrated Bulletin #73.



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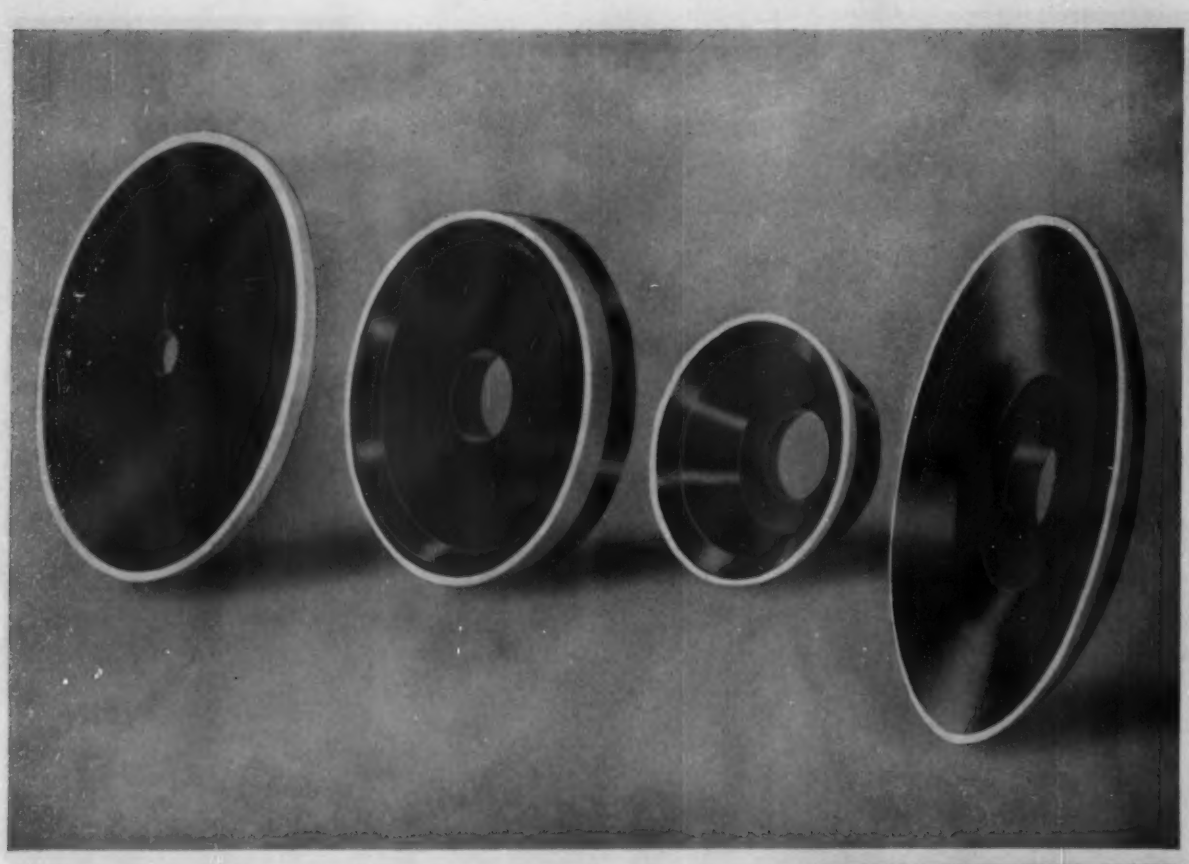

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- Longer Life
- Bonded for Specific Grinding Requirements
- Natural or Man-made Diamonds

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ENGINEERED RUBBER PRODUCTS ..."MORE USE PER DOLLAR"

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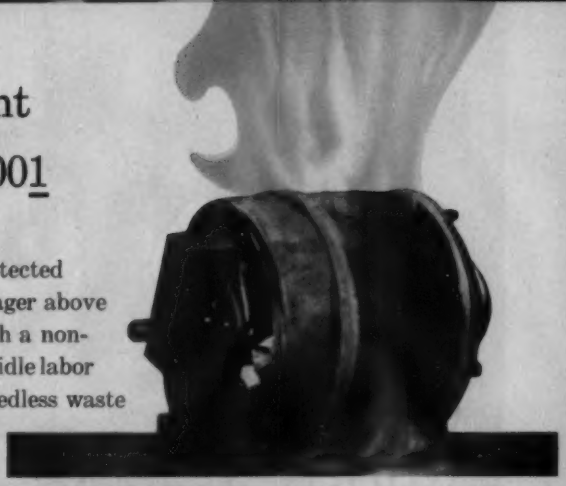
WRITE TO DIAMOND WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, N.J.

RAYBESTOS-MANHATTAN, INC.

The man who bought equipment powered by motor No. 200,000,001

Our figures tell us that approximately 200,000,000 motors are protected from burnouts with KLIXON Protectors. Anyone, as the plant manager above learned to his sorrow, who buys a piece of equipment powered with a non-protected motor takes a needless risk of costly machine downtime or idle labor time caused by motor burnout due to overheating. It is such a needless waste of operating profits. Motors with built-in KLIXON Protectors cost but little more. They are available for 3-phase or single-phase operation from your motor supplier. Specify them on all your electric-powered machinery. Write for Bulletin SP-25.



PREVENT MOTOR BURNOUTS

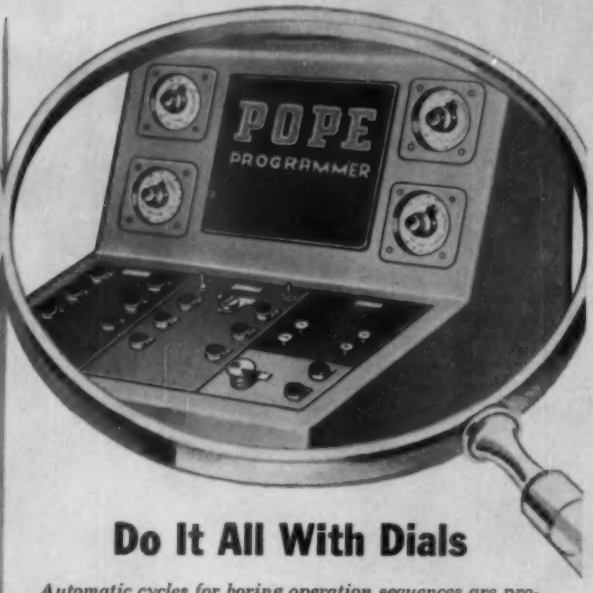
SPECIFY KLIXON PROTECTORS

ON SINGLE- AND 3-PHASE MOTORS

TEXAS INSTRUMENTS
INCORPORATED
METALS & CONTROLS DIVISION
9511 FOREST STREET • ATTLEBORO, MASS.

YOU CAN INCREASE PROFIT AND PRODUCTION

with this new POPE 10-6 SUPER-PRECISION BORING MACHINE



Two Heads Are Better Than One

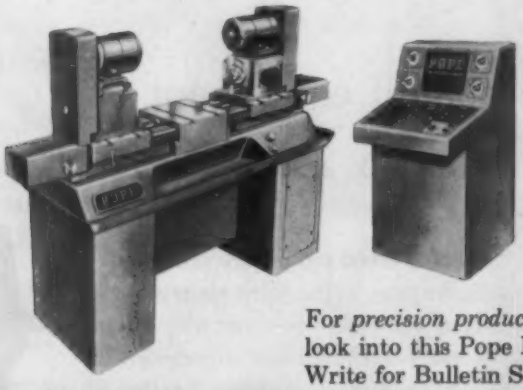
and of course you can have more than one spindle in each head. The Pope Model 10-6 features *two precision boring heads** operating completely independently of each other to provide simultaneous or alternate cycling movement of the heads. *This means increased production.*

*The Pope Boring Head Spindles on this machine revolve within 20 Millionths.

Do It All With Dials

Automatic cycles for boring operation sequences are programmed on these dials. The operator simply determines the sequence of operations and dials each one. You get continuous production of uniform parts in less time.

The Pope Electric Programmer gives you finger-tip fast control of infinitely variable speed, distance and operating sequence. You dial in the complete program with ease and speed that beats expensive numerical or tape control. Supreme accuracy is maintained for cycle after cycle.



For *precision production at a profit* look into this Pope Model 10-6. Write for Bulletin S-21.

No. 132

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means precision
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With dimensional tolerances on parts steadily being reduced, roundness determination is a continuing concern to manufacturing men. Here's a 12-page compendium of up-to-date opinion, advice and methods on roundness. Priced at 35¢ each, you can secure a copy by writing

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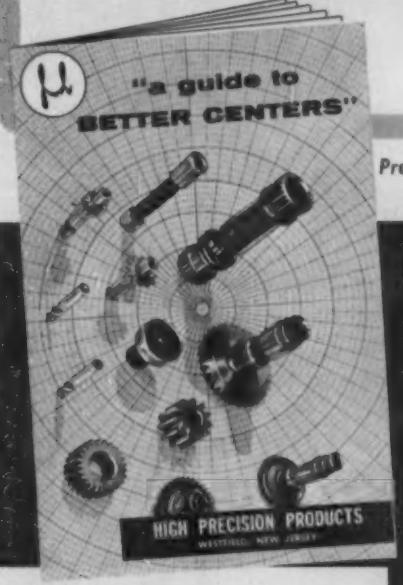

Prepared by
Dr. Gilbert Dannehower, M.E., D.S.

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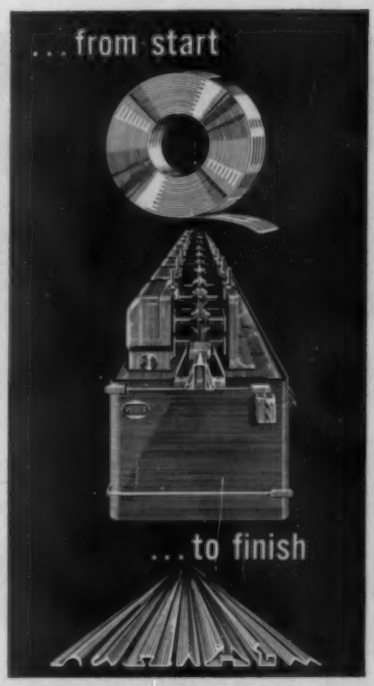

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Produce tubular, ornamental or structural shapes from a variety of metals in widths from a fraction of an inch up to 80 inches or more, and in stock up to ¾" thick. Your investment is comparatively modest, and with proven low operating costs, will give you one of the most profitable operations in your plant.

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When you can use South Bend Milling Machines for tool and die work and fill in free time with production runs, you've got an ideal situation. Here Metal Processors are drawing upon the two main capabilities of these machines—accuracy for exacting work and productivity for manufacturing operations.

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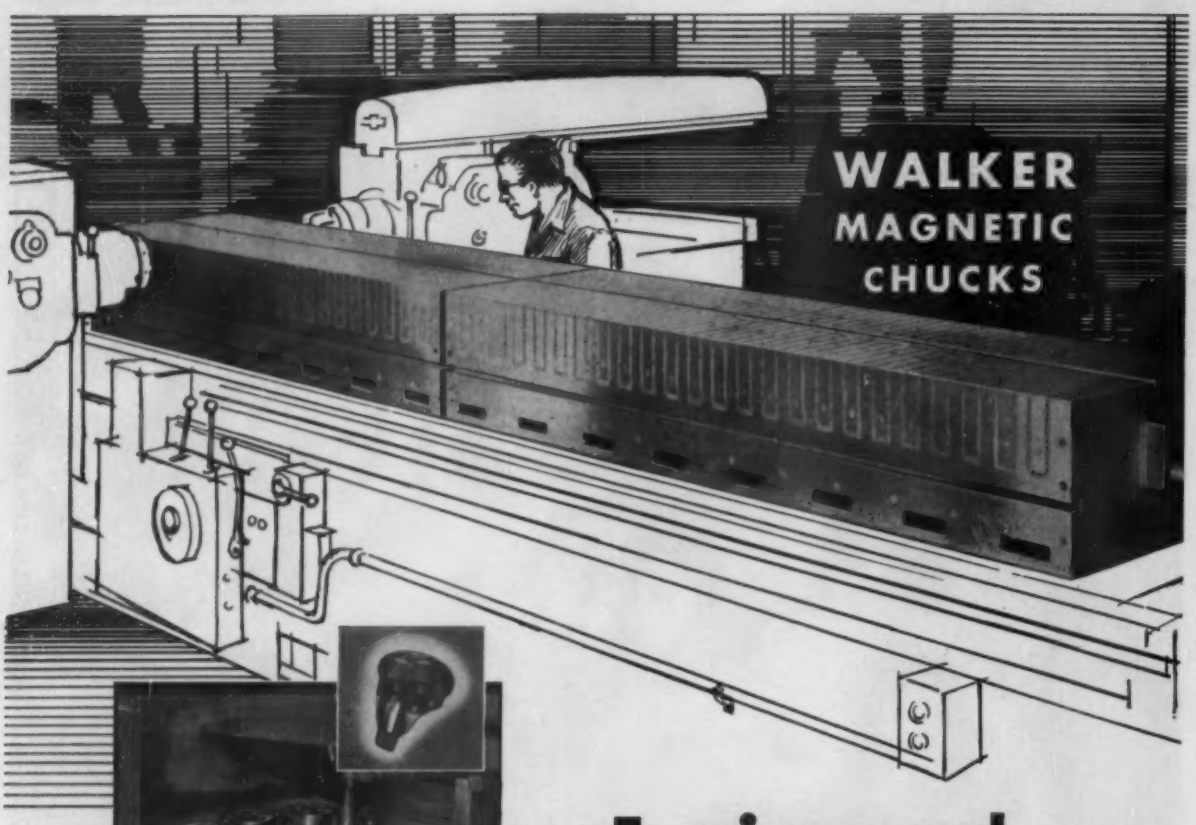
Builders of Lathes • Milling Machines • Shapers • Drill Presses • Pedestal Grinders



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Walker engineers are continuously solving *new* holding problems for industry. The three-faced electromagnetic chuck above is only one example of the special designs created by Walker ingenuity and "knowhow". Whether you need any one of the complete line of standard magnetic chucks or a specially designed item, your best source is Walker.

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Original Designers and Builders of Magnetic Chucks

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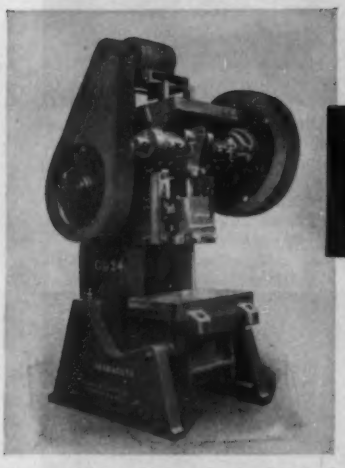

A complete line of mechanical presses for cutting, forming, drawing and embossing. This 60 ton O.B.I. *Mechanical Press* is typical of the modern design of Ferracute presses and incorporates the latest features in gap frame construction. Available from 32 ton to 200 ton capacities. Basic design meets J.I.C. standards. Air clutch and brake standard on presses of 100 tons and up — optional on other sizes.

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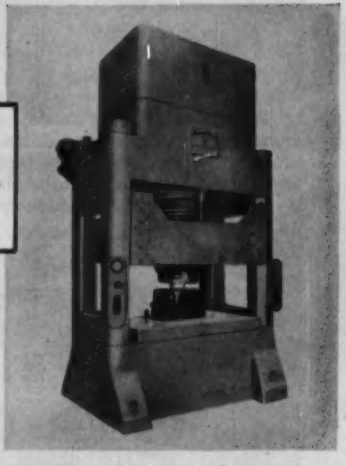
PRESSES

This broad and versatile line of modern presses—mechanical and hydraulic—plus the experience of our Ferracute—Farquhar engineers will help you turn your press problems into profits. Phone or wire today—no obligation, of course. Dept. A



Farquhar Hydraulic Presses in a wide range of popular standard capacities and special sizes to meet your precise production requirements. The unusually rigid construction of this 400-ton straight-side Hydraulic Press assures minimum deflection under full loads and close tolerance operation for difficult and rugged forming and drawing operations. Simplified controls for pressure, speed and stroke adjustment reduces set-up time and increases production.

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Mechanical and Hydraulic Presses and Special Machinery Since 1863 in Bridgeton, New Jersey, U.S.A.

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Number 2 of a series.

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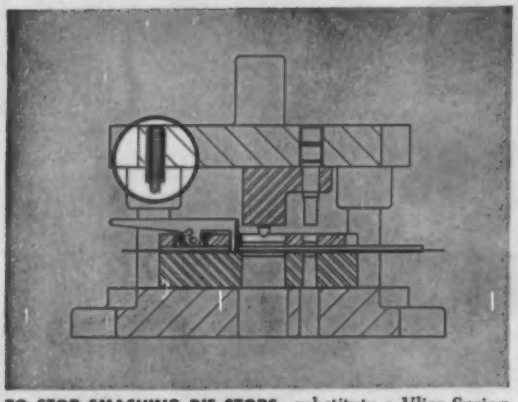
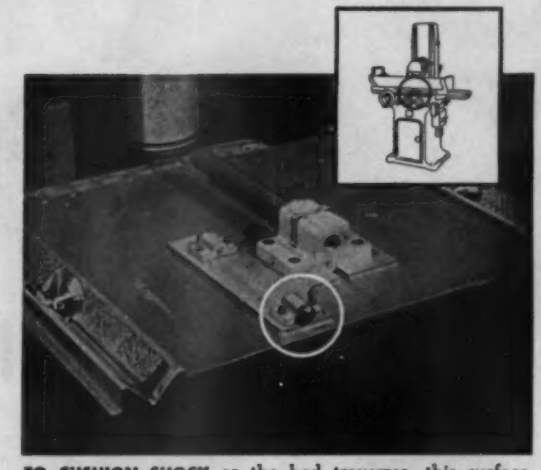


TO STOP SMASHING DIE STOPS, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 30 sizes.



TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.

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THESE PARTS ARE BEING PRODUCED AT SPEEDS OF 90 TO 250 PCS/MIN

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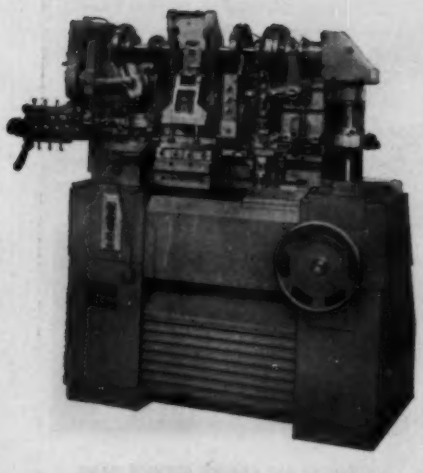

These are formed parts produced in single automatic operations on the revolutionary new Torrington Vertical 4-Slide.

With precision and speed, the Verti-Slide has replaced as many as five and six progressively tooled presses in the production of a complex part. Normal secondary operations such as welding are being done in one continuous automatic operation in excess of 100 pcs/min.

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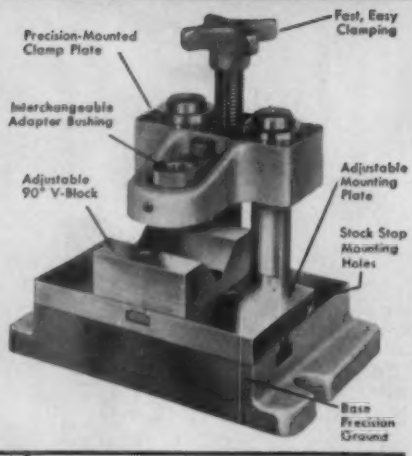
REPCO *Time-Saving Tools*

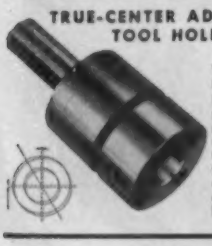
ADJUSTABLE V-BLOCK DRILL JIG

Saves Set-Up Time— Increases Output

Here is a versatile and accurate V-Block that makes center and off-center drilling, tapping, and reaming easy and precise. Four-way V-block adjustment simplifies handling a wide range of work. Fast, easy positioning and clamping speed production. A centering locator plug and T-slots in the mounting surface plates assure fast, easy, on-center adjustment. Drill capacity #80 to 5/16" diameter. Handles stock from 1/4" to 2" diameter.

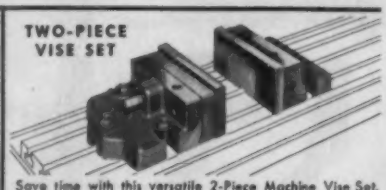


TRUE-CENTER ADJUSTABLE TOOL HOLDER



The REPCO Adjustable Holder is a precision-built tool, having two-piece construction which provides fast adjustment of the main body to compensate for as much as 1/32" machine misalignment. Cuts down on tool wear, breakage, and scrap.

TWO-PIECE VISE SET

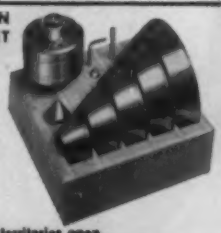


Save time with this versatile 2-Piece Machine Vise Set. Use as general-purpose vise, angle-block, or separate clamping device. Opening limited only to length of machine base. Light, accurate, rigid. Two sizes: 6" and 8".

CHUCK JAW TRUING-RING SET

This Ring Set saves time, cuts cost of boring jaws. With correct diameter rings at hand, you gain hours of productive time. Plated rings range from 1" to 4" by 1/8" increments. Handy peg-type rack keeps rings in place.

COMBINATION LIVE-CENTER SET



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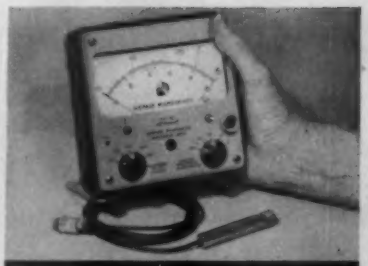

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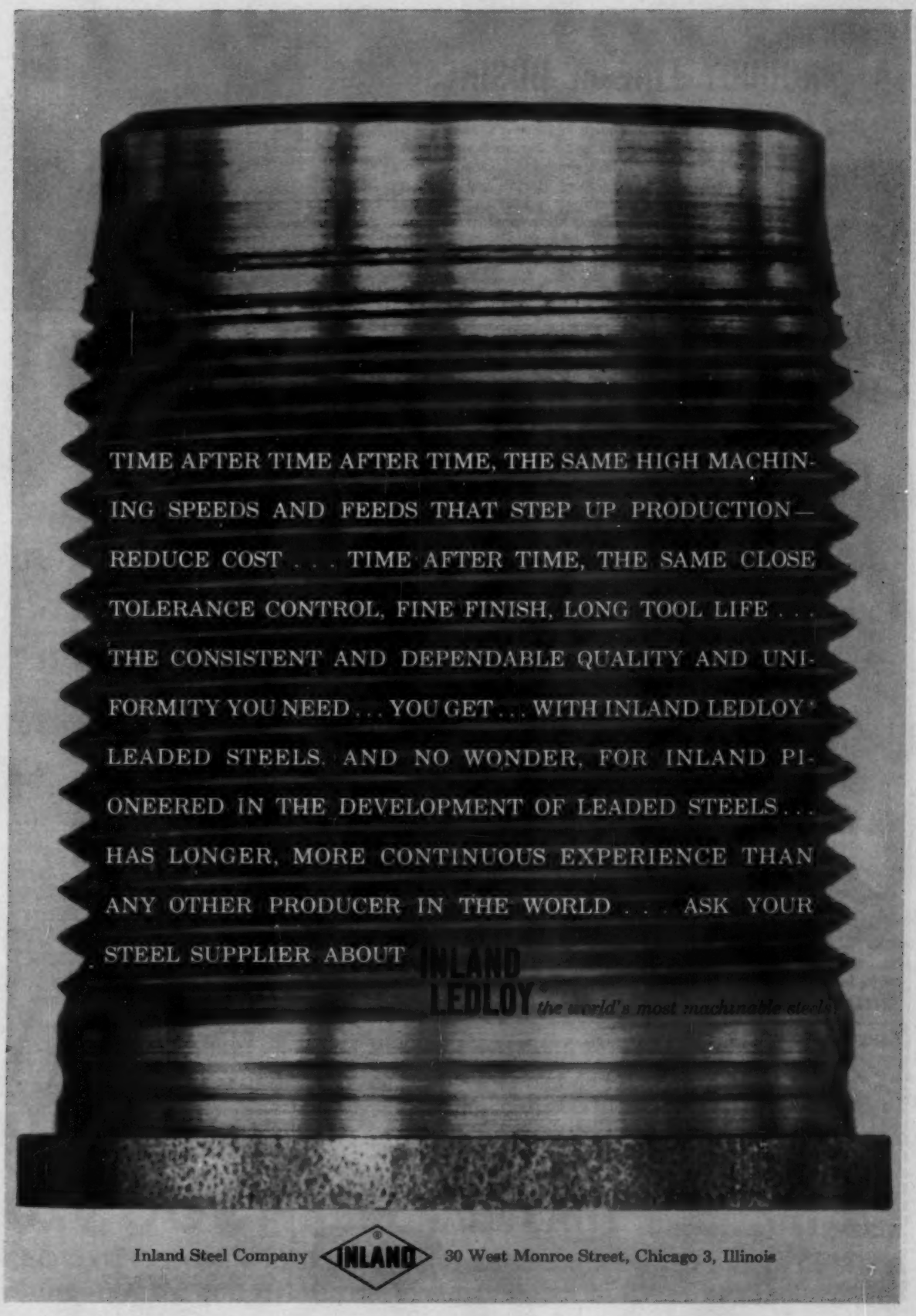
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5' bed—31" centers

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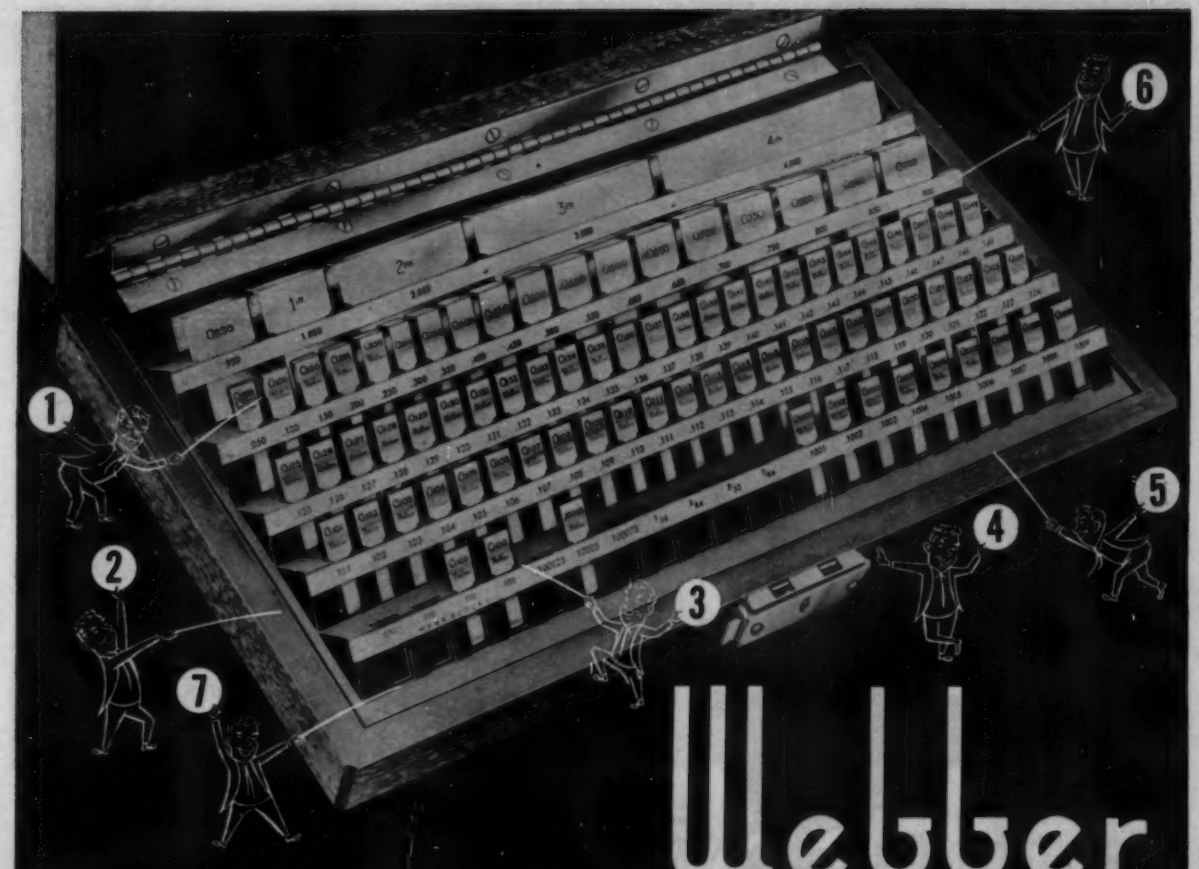

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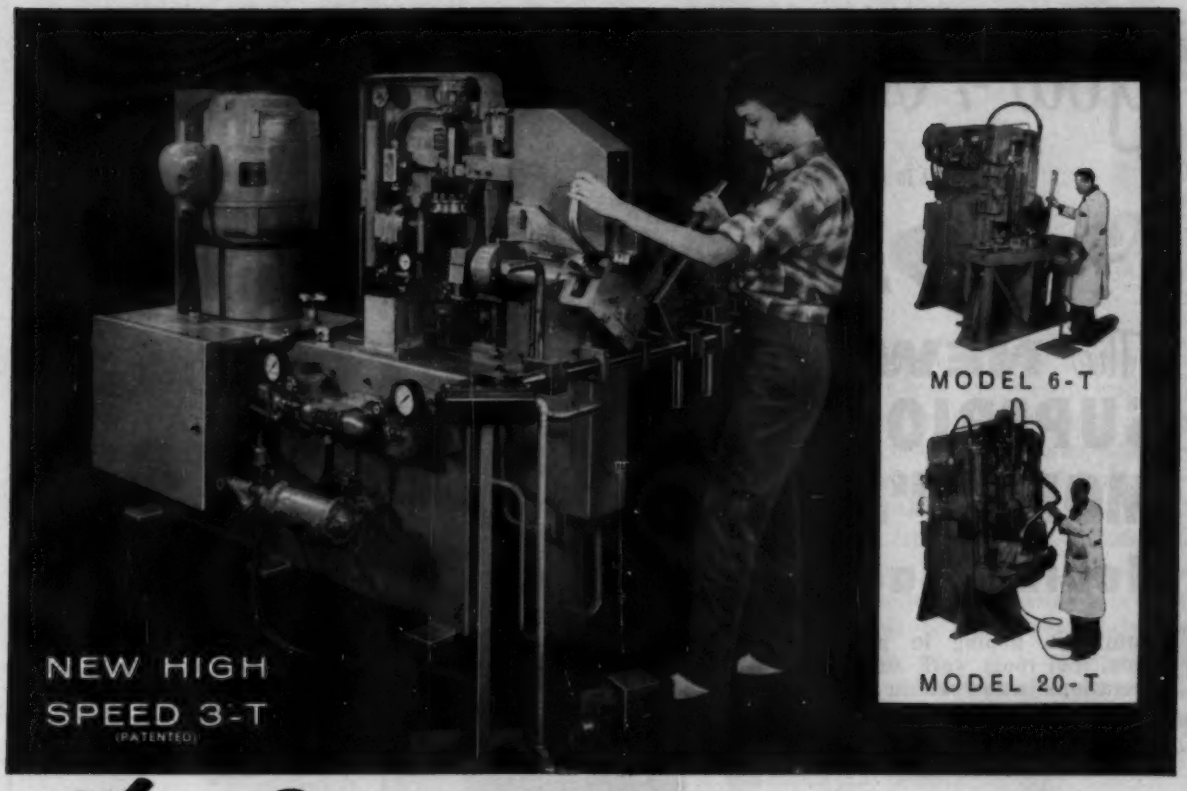

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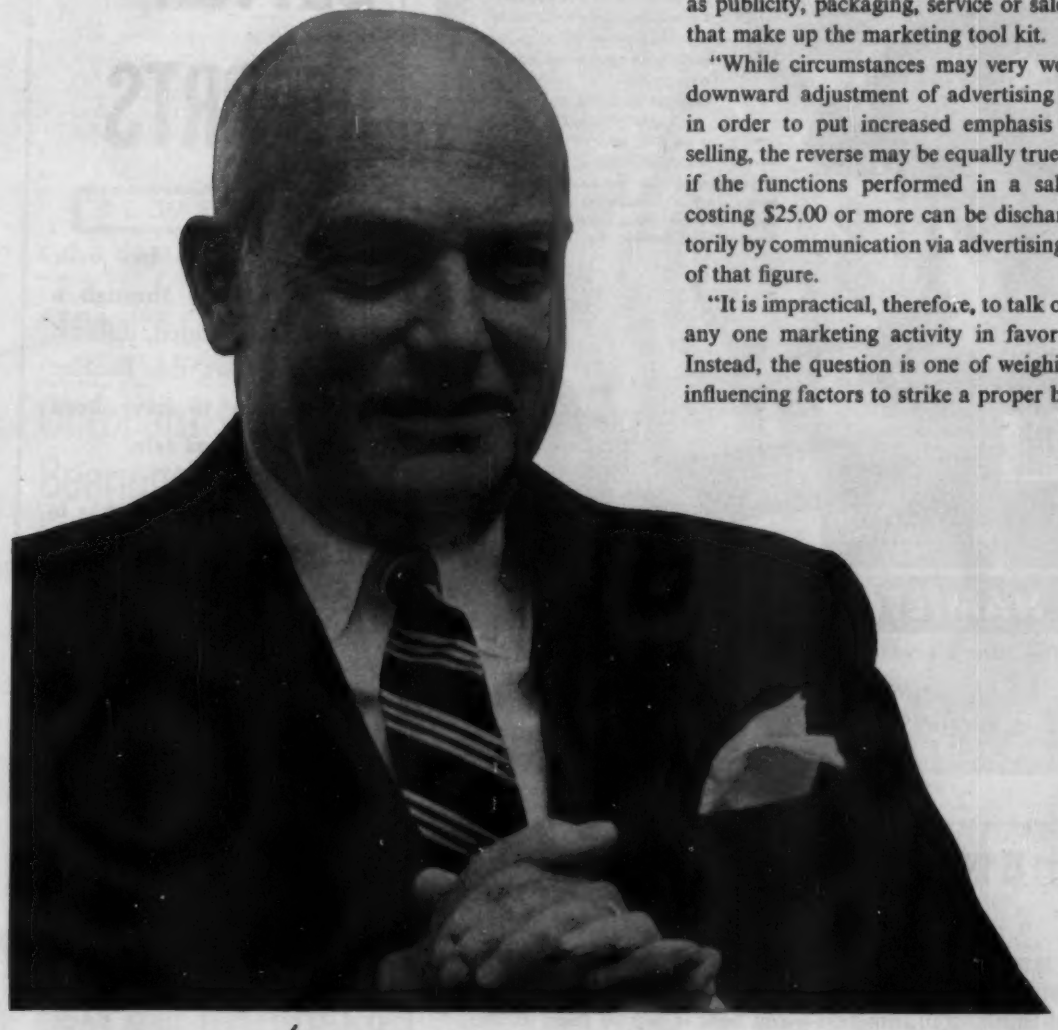

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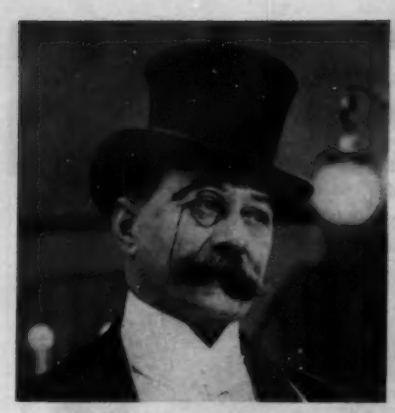

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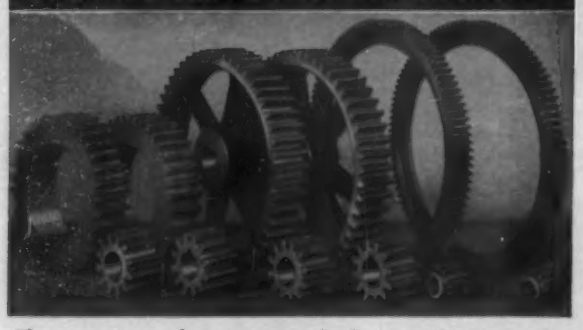

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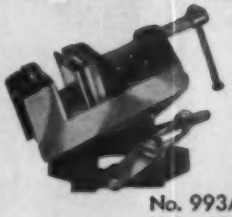
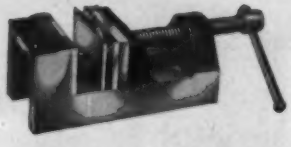


No. 4993A
Swivel-Tilt Vise
3" Jaws



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New No. 993A Utility Vise with 3" Jaws—precision-built for machine shop use.

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STANLEY The Tool Box of the World

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SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

GOVERNMENT SALE

BORING MILL AND OTHER MISCELLANEOUS EQUIPMENT

Sealed Bid Opening, Nov. 23, 1960

This sale consists of approximately $150,000 in equipment as follows: (a) Boring Mill, Vertical, Heavy Duty, Mfg: Consolidated Machine Tool Corp., Rochester, N.Y., Model: Betts 23', Yr. built: 1926, Serial No. E2041. Capacity: 25' swing, Max. swing dia. 25'4", Max. vertical travel of tool holders 16', Max. spindle travel 7', Double pinion drive, including lubricating pump and system, 1-Main magnetic control panel, 1-Speed controller, 2-Master Switch boxes, 2 Start and Stop push button switches, 2 Tool holder blocks, 2 operators stations, 1 gear drive box. Motors: 50 HP, DC, 230v., 400/1200 RPM; 15 HP, DC 230v., 1150 RPM; 1 HP, DC, 230v. 1150 RPM, Weight: 480,000#.

(b) Bloker.

(c) Shaper, space heater and grinding machines. Inspection dates are from Nov. 14 through Nov. 21, 1960, except Sat., Sun., and holidays, between the hours of 9:30 AM and 3:30 PM at the following locations: (a) Baldwin-Lima-Hamilton Corp., Eddystone, Pa., (b) U.S. Post Office, Bradford, Pa., (c) G.S.A., Defense Materials Service Preservation Depot, Burlington, N.J.

Bids will be received on Bid Form #GS2-USD-S-61-45 at the below listed office up to the bid opening time, 10:00 AM, EST, Wed., November 23, 1960 at which time they will be publicly opened and read. Bid Forms may be obtained at the inspection sites or at the below listed office.

For further information contact:

GENERAL SERVICES ADMINISTRATION
BUSINESS SERVICE CENTER
250 Hudson Street
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Cimco

96" x 96" x 20' Cincinnati Hypro Double Housing Planer, 4 heads, pneumatic tool lifters, late.

6'10" column American Holowizard Radial Drill column extended 2', 32 speeds, late.

14' x 12' x 50' Betts Double Housing Planer, 50 HP DC motor, 4 heads, box table, ACTUAL PHOTOGRAPH AVAILABLE.

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48T Giddings & Lewis table type boring mill, table 40 x 48 outer support, late type.

Model 300 Hanchett, 18 x 48" table, complete with magnetic chuck and rectifier, late type.

24" x 72" Sidney G.L. late, 16 speeds, Timken bearing, taper attachment.

16" x 48" Thompson Hydraulic Surface Grinder, late type, AC motor.

4A Warner & Swasey Saddle Type Turret Lathe, 24" 3 jaw chuck, 3¼" hole in spindle.

#32 Williams & White Multiple Punch, double crank, double geared.

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Cincinnati Machinery COMPANY

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CIRCLE 603 READER SERVICE CARD

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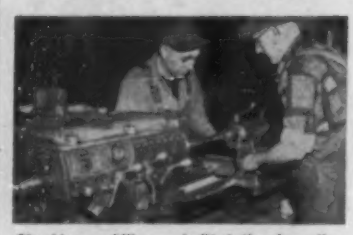
at its Best



Checking a Miles re-built lathe for alignment of spindle with bed. Runout is held within .0005" per foot which is substantially below new tool standards.

Cut-Off No. 3 Modern
Drill, Heavy Duty, 28" No. 217 Baker Bros.
Drill, Horizontal, W.F. & J. Barnes Model 420, deep hole
Drill, Multiple, Model B2A Natco holestest, hyd.
Drill, Radial, 5'-13" Cincinnati Bickford Super service
Drill, Sensitive, No. 2LMB Leland Gifford woodworker, hyd.
Drill, Upright, 24" Cincinnati Bickford sliding head
Drill, Driver, No. 18½ Foote Burt vertical hydraulic for mtg. multiple hd.
Gear Hobber, No. 79 Lees Bradner
Gear Shaver, Model GCC 8" Red Ring
Gear Shaper, No. 7A, Model 7125A Fellows univ.
Gear Tester, No. 18 Gleason univ.
Grinder, Centerless, No. 12 Landis new 48
Grinder, Cylindrical, 10"x24" Landis type C, univ. hyd.
Grinder, Cylindrical, 10"x30" Norton type C plain
Grinder, No. 86 Gardner opposed wheel double disc
Grinder, Internal, No. 74 Heald cross sliding headstock
Grinder, Internal, No. 1616 Bryant
Grinder, Surface, 12" No. 22 Heald rotary
Grinder, Style L-26-B Ex-Cell-O double end carbide
Grinder, No. 48 Van Norman radius
Groover, Wiesco continuous, late
Hone, Model 226 Barnes vertical internal hydraulic
Keyseater, No. 8 Baker
Lathe, 16"x33" Fay automatic
Lathe, 24"x108" oc American geared head GCG
Lathe 26"x14" 10" Wickes, heavy duty, selective geared hd.
Lathe, Production, 15"x30" Lips Carbo
Lathe, Turret, No. 2 Warner & Swasey with new electric bar feed
Lathe, Turret, No. 5 Gisholt ram type univ.
Lathe, 60" Model T Lodge & Shipley, right angle, chucking

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MACHINE TOOLS IN STOCK
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PRICE F.O.B. East Boston ..... $9500.00 each

WIGGLESWORTH MACHINERY COMPANY
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CIRCLE 606 READER SERVICE CARD

SEARCHLIGHT SECTION
ADVERTISERS' INDEX AND BUYERS' REFERENCE

Listed below are used, surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name indicates the products or services offered by the advertiser.

2. Auctions
3. Automatics
7. Boring Mills
14. Cutting Off Machines
17. Drilling & Reaming Machines
20. Fabricating Equipment
25. Gear Cutting Machines
26. Grinding Machines
28. Honing & Lapping Machines
30. Keyseaters
31. Lathes
32. Liquidating & Appraising Plants
33. Machine Tools
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This service is aimed at helping you, the reader of "SEARCHLIGHT," to locate rebuilt and used machine tools and equipment, not currently advertised. (This service is for USER-BUYERS only.) No charge or obligation.

How to use: Check the dealer ads to see if what you want is currently advertised. If not, send us the specifications of the equipment and/or components wanted on the coupon below, or on your own company letterhead to

SEARCHLIGHT EQUIPMENT LOCATING SERVICE
c/o American Machinist/Metalworking Manufacturing
Classified Advertising Division, P.O. Box 12, N. Y. 36, N. Y.

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TITLE ..... COMPANY .....

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11/14/60

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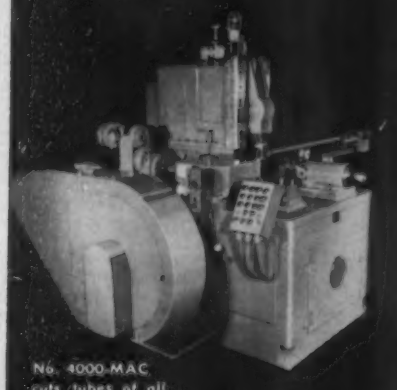

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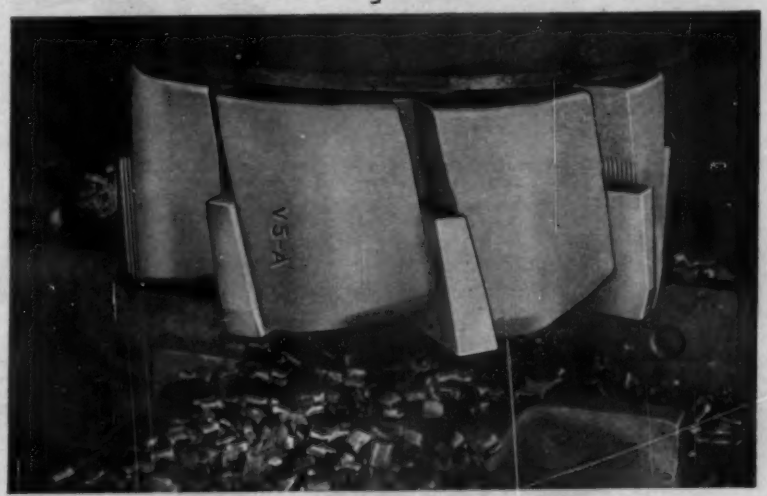

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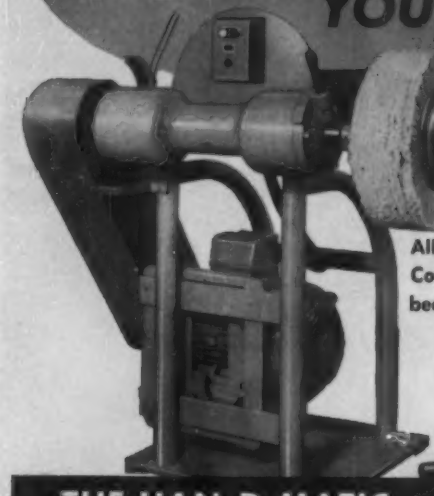

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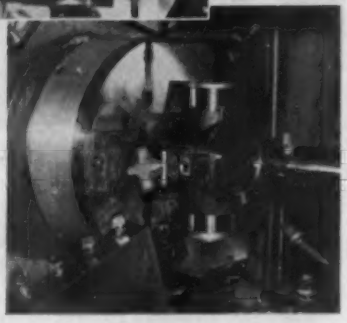

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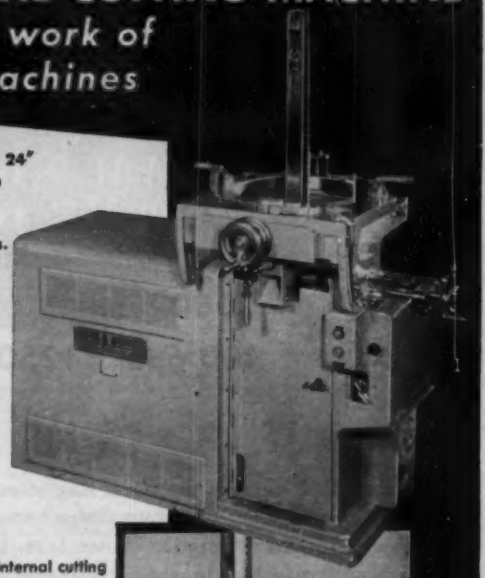
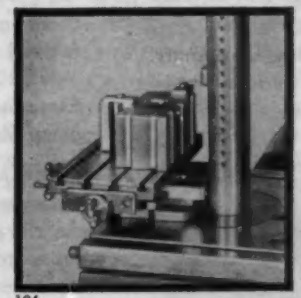
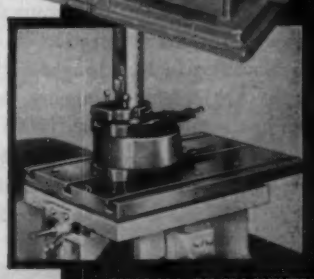


Right: Set-up for internal cutting

Below: Set-up for external cutting





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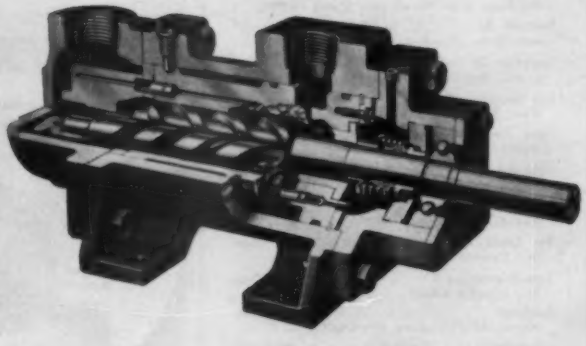

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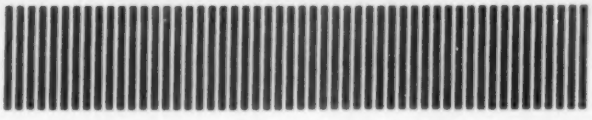

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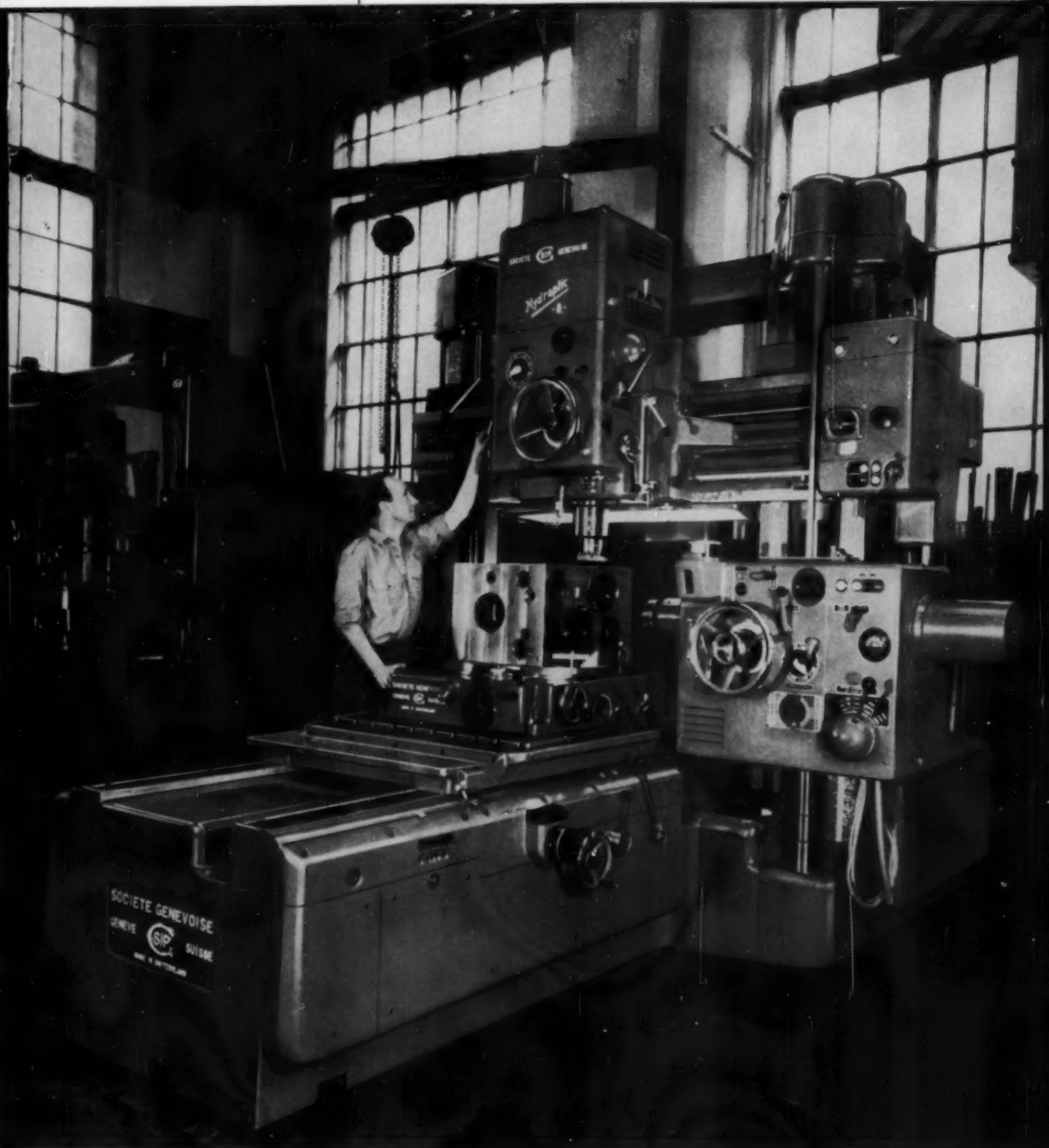

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